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South Tacoma Field
Superfund Site
Tacoma, WA

Air Investigation

Preliminary Dispersion Modeling Report

Draft of
Dispersion model screening analysis

Prepared by
Envirometrics, Inc.

K/J Project No. 916055.11

Draft Report

AIR INVESTIGATION

PRELIMINARY DISPERSION MODELING REPORT

SOUTH TACOMA FIELD
SUPERFUND SITE
REMEDIAL INVESTIGATION AND FEASIBILITY STUDY

DRAFT

Prepared for

SOUTH TACOMA FIELD SITE GROUP

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15 October 1991

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EXECUTIVE SUMMARY

This report provides details of the preliminary dispersion modeling of air emissions pathways associated with the South Tacoma Field Superfund site, as required by the *Air Investigation Plan - South Tacoma Field Superfund Site - Remedial Investigation and Feasibility Study* (Envirometrics, 1991). In summary, it describes the physical setting, and the geographic, emissions, and meteorological data utilized in the execution of the models, the locations of the receptors, the modeling methodology, and the results.

This report begins by briefly describing the physical setting of the South Tacoma Field Superfund site, the history of the site, the federal, state, and local air quality rules that are applicable to the air pathways analysis, and the objectives of the air investigation. Next, it describes the soil chemicals that might enter the air pathway and the rationale for the selection of particulate matter less than 10 micrometers in diameter, lead, and polynuclear aromatic hydrocarbons as the chemicals to be included in this modeling study.

This report includes a description of how the estimates of the emissions from the soil surface were developed, including a description of the existing soil surface and the existing data on soil chemical concentration. The meteorological data are described and a previous report on the use of the data is summarized. The locations of the receptors are described and shown. The reasons for selecting the Fugitive Dust Model and the Point-Area-Line model for use in this study are given and the use of these models is described.

The locations of the maximum off-site concentrations are all at the southern property boundary, at Proctor Street. The estimated concentrations at this location are dominated by the wind blown dust which is raised by traffic to the Tacoma Industrial Properties facilities. The maximum daily average concentration for particulate matter contributed by this site is estimated at less than 20 micrograms per cubic meter ($\mu g/m^3$) and the maximum annual concentration is less than 2 $\mu g/m^3$. The estimated maximum quarterly average for lead is less than 0.3 $\mu g/m^3$. Similarly, the estimated maximum annual average concentration of polynuclear aromatic hydrocarbons is less than 5×10^{-11} g/m^3.

The locations of the maximum on-site concentrations are along Proctor Street, on the Tacoma Industrial Properties. These locations are also dominated by the wind blown dust from the traffic on Proctor. The maximum daily average concentration for particulate matter contributed by this site is 41 $\mu g/m^3$ while the maximum annual average is 2 $\mu g/m^3$. The estimated maximum quarterly average for lead is less than 0.5 $\mu g/m^3$ and the maximum annual average concentration for polynuclear aromatic hydrocarbons is less than 1×10^{-10} g/m^3.

These estimated concentrations of the modeled chemicals are sufficiently small that further air pathways analyses are warranted only if the soil chemicals concentrations measured in the Phase I soil investigation are more than an order of magnitude greater than the concentrations used in this study. No ambient monitoring is warranted at this time at any location adjacent to the site.

1.0 INTRODUCTION

1.1 SITE DESCRIPTION

The South Tacoma Field (STF) Superfund site is located in southwestern Tacoma, Washington about 1.5 km southwest of the Interstate 5 and Washington 16 intersection, as shown in Figure 1. The site is bounded on the south by South 56th Street and by South 35th Street on the north. The western boundary is close to Manitou Way and Tyler Street and the eastern boundary is the Burlington Northern Railroad right-of-way.

1.1.1 Local Topography

The STF site occupies the flat, glacial valley floor of a north-south valley which slopes down to the north. The floor of the valley sits at about 70 to 80 meters above mean sea level (MSL). The walls of the valley rise to 116 meters MSL on the west and 122 meters MSL on the east. At the site the valley is about 900 meters in width. At the north end of the site, the valley curves abruptly to the east and narrows to 365 meters in width. Approximately 365 meters south of the site, the valley opens up to the west to an eventual width of about 1500 meters. About 3000 meters further south, the east side of the valley opens to a broad plain where McChord Air Force Base is located.

The valley is sufficiently narrow and deep that microclimate valley flows can be expected, downvalley to the north in the evening and night, and upvalley to the south in the morning and mid-day, whenever the gradient wind is not strong enough to dominate the local surface winds.

1.1.2 Near-by Meteorological and Ambient Data Locations

Also marked on Figure 1 (by stars) are three near-by sources of meteorological and ambient monitoring data. McChord Air Force Base collects a full spectrum of meteorological data. Observational data are collected at the tower, while wind speed and direction are collected at monitors at the north and south ends of the runways. A meteorological and ambient air quality monitoring station was operated by the Washington Department of Ecology (WDOE) at the Mt.Tahoma High School, about 300 meters south of the site, from 1978 through 1987. In addition to meteorological data, data were also collected on particulate matter, visibility, sulfur dioxide, and ozone during most of the time this site was operational. The Puget Sound Air Pollution Control Agency (PSAPCA) operates an ambient air quality monitor at South 32nd and South D Streets in Tacoma. Total suspended particulate data have been collected at this site since 1973. Sampling at this site is scheduled to be discontinued this year.

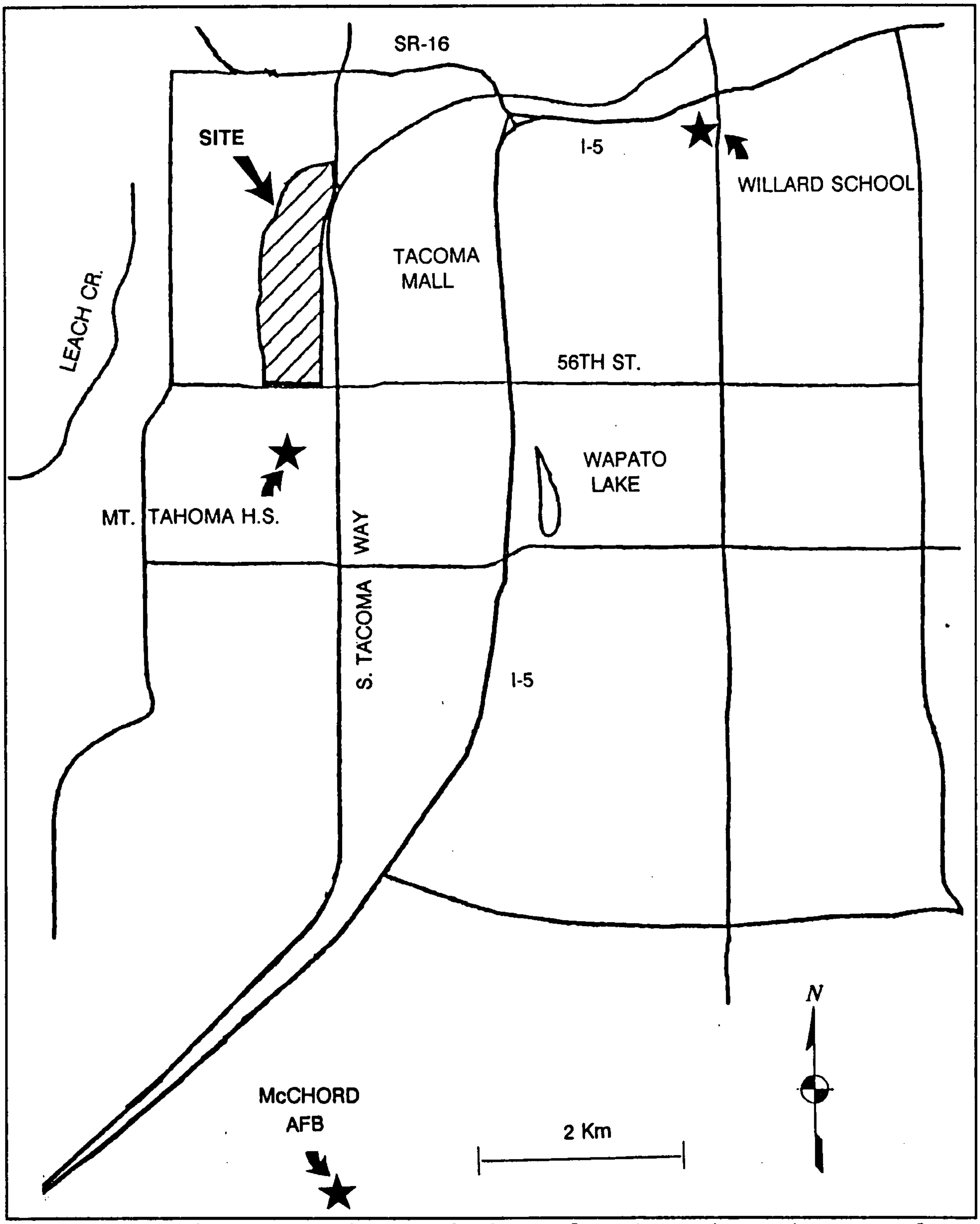

Figure 1. South Tacoma Field Superfund site location and near-by meteorological and ambient monitoring stations.

1.1.3 Surrounding Community

Five businesses are currently operating on the site. General Plastics operates a plastics manufacturing facility in the south central part of the site. Pioneer Builders operate a warehouse and distribution center in the south east corner of the site. Tacoma Industrial Properties in the south central part of the site houses three manufacturing and assembly plants.

Except on the northwest, there is only limited residential development immediately adjacent to the site. Most of the development on the east of the site, along South Tacoma Way and adjoining streets, is commercial. The hillside immediately to the west is relatively undeveloped and portions have been used as landfill. However, residences are located further away from the site, with a population of about 25,000 within 1.6 km of the site. Four kindergartens, 13 schools, and six nursing homes are located within 1.6 km of the site.

1.2 SITE HISTORY

1.2.1 Historic Site Uses

The Northern Pacific Railroad purchased land at STF in the early 1890s and operated a manufacturing and repair facility there until 1974. The South Tacoma Car Shops, including a roundhouse and a variety of brick buildings, was used to build rail cars (i.e., passenger and freight cars, tool cars, wrecking cars) and cabooses. It was also used for the repair and maintenance of existing rail equipment, such as engines, boilers and tanks, and cars. The number of people working at the shops is not known but is estimated to be about 800 to 1200 in the early part of the century. The Car Shops covered as much as 200 acres at one time.

The Car Shops were closed following the consolidation and merger of the Northern Pacific into the Burlington Northern railroad. Most of the then existing structures in the Shops were demolished at that time. A few of the buildings are now used by tenants of Tacoma Industrial Properties.

A Dismantling Yard was located at the north end of the Shops (and STF) area. Cars were brought to this area for cleaning prior to repair or for dismantling. Non-recyclable discarded materials were buried in a dump at the west end of the Dismantling Yard. Materials were burned at several locations in the Dismantling Yard.

Two foundries operated at the site. An iron foundry produced iron wheels for sale to the railroad from the late 1890s until 1957 when the railroad switched to steel wheels. The iron foundry building is still used by tenants of Tacoma Industrial Properties.

A brass foundry operated on the site from the late 1890s until 1980 producing journal bearings for sale to the railroad. The brass and bronze products included lead, tin, copper, and zinc. Used bearings were melted down and depleted metals added before recasting. The site is still owned by Amsted and is referred in this report as the Amsted property. The building was demolished in 1989.

On the west side of the STF site was a small general aviation airport. The airport was in use between 1936 and 1973. The runway was made of oil mat, produced by spraying "paving oil" on a crushed rock base. A seaplane landing area was provided by a lake which existed in earlier years south of the air strip.

The Fick Foundry and the Atlas Foundry disposed of their wastes (primarily slag and foundry sand) in two sites in the area south of the airstrip. Use of the site was discontinued in about 1980.

1.2.2 Current Site Uses

General Plastics purchased a portion of the Car Shops area in 1979 and built a high-density plastic foams manufacturing facility. About 100 people are employed at the plant. Employee and visitor access to the General Plastics building is from Burlington Way, a public road.

At the northern-most end of the STF site is the maintenance and repair facility of Tacoma Public Utilities (including City Light). It is currently in use with about 600 people working from this site. About half of those are support personnel who are at the site all day. Almost the entire site is covered with paving or buildings. Employee and visitor access to the Tacoma Public Utilities site is from South 35th Street, a public road.

Pioneer Builders Supply purchased a portion at the southeast corner of the Car Shops area in 1986 to build a distribution center for roofing supplies. About 30 persons work in the distribution center. Employee and visitor access to the Pioneer Builders Supply distribution center is from Burlington Way, a public road.

Tacoma Industrial Properties (TIP) rents portions of the former iron foundry and several buildings that were once part of the Griffin wheel manufacturing operations to three companies. Savage Industries makes picture frames, KML Corp. makes particle board laminates, and North Coast Electric distributes electrical parts and equipment. North Coast Electric is currently building a new warehouse on the TIP site. A total of about 50 workers are employed in these three plants. Northwest Fabrication operated out of a building on the TIP site until recently. It is no longer in business. Employee and visitor access to the TIP site is from Proctor Street, which is a public way only up to the boundary of the STF site. Within the STF site Proctor Street is a private access road.

Madison Street and Fiftieth Street (to Madison) are shown on the recorded plat of the site, but the site was never developed and these streets are currently blocked and not accessible to the public.

Figure 2 illustrates the various areas described in Section 1.2.

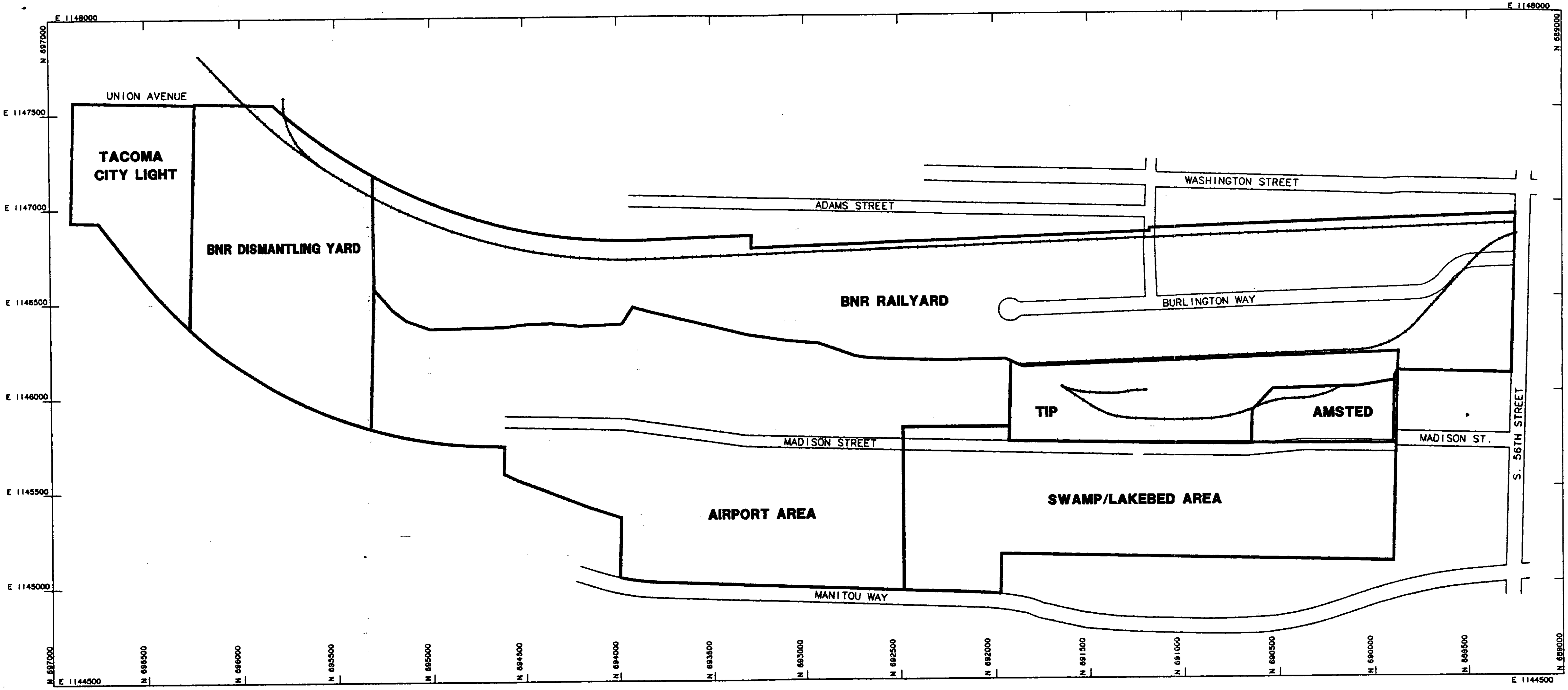

Figure 2. South Tacoma Field Superfund site.

BASE MAP REFERENCE:
KENNEDY/JENKS CONSULTANTS

1.3 POTENTIALLY APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR AIR PATHWAYS

1.3.1 National Ambient Air Quality Standards

Standards have been established by the U.S. Environmental Protection Agency (EPA) for acceptable ambient concentrations of common air pollutants (40 CFR 50 et seq.). These include fine particulate matter (dust less than 10 micrometers, termed PM-10), sulfur dioxide, ozone, carbon monoxide, nitrogen oxides, and lead. Only two of these standards are relevant to the potential emissions from this site, PM-10 and lead.

Dust, undifferentiated by composition, which is raised by the movement of vehicle traffic or which blows off the surface of the soil is subject to the PM-10 regulations. The standard for PM-10 concentrations in the ambient air is 150 $\mu g/m^3$ averaged over one day (24 hours) and 50 $\mu g/m^3$ averaged over an entire year. The daily standard is not to be exceeded more than once a year. That is, the second-highest concentration recorded during a year determines if the standard has been exceeded. Thus in this report the highest second-high concentration at any receptor will be reported.

An area in the primary industrial district of Tacoma (primarily the Tacoma Tideflats) has been designated by the EPA as exceeding the national ambient air quality standards ("non-attainment area"). Because air quality monitors north and south of the STF site have exceeded the standards in recent years, the STF site is included in the designated non-attainment area. Certain restrictions apply to applications for new air emissions permits from sources located in the non-attainment area.

Lead in the dust which blows off the site is regulated directly, in addition to the PM-10 standard on the dust itself. The standard for lead concentrations in the ambient air is 1.5 $\mu g/m^3$ averaged over a calendar quarter (e.g., January through March). This concentration is not to be exceeded.

Under the adopted State Implementation Plan for Washington, both the state and local air agencies enforce these same standards for particulate matter and lead. In addition, the state (WAC 173-470) and PSAPCA (Reg I:11.03) have retained a previous federal standard for total suspended particulate (TSP). Like the PM-10 standard, this standard applies to dust, but additionally to larger sized particles. The upper size limit of the TSP standard is not well defined but is approximately 75 to 100 micrometers.

The standard for TSP concentrations in the ambient air is 150 $\mu g/m^3$ averaged over one day (24 hours) and 60 $\mu g/m^3$ averaged over an entire year. The daily standard is not to be exceeded more than once a year. The annual TSP standard is a geometric average. These are more stringent standards than the PM-10 standards since the concentration is the same, or almost the same, but includes much more and larger-sized material.

1.3.2 State and PSAPCA Dust Deposition Regulations

The state (WAC 173-470) has adopted a standard for the fallout of dust, undifferentiated by size or composition, not to exceed 10 g/m^2/month in an industrial area and 5 g/m^2/month in a commercial or residential area.

PSAPCA (Reg I:9.04) regulates the fallout of dust through a nuisance regulation, prohibiting fallout "in sufficient quantities and of such characteristics and duration as is, or is likely to be, injurious to human health, plant or animal life, or property, or which unreasonably interferes with enjoyment of life and property."

1.3.3 State and PSAPCA Air Toxics Regulations

The recently enacted amendments to the federal Clean Air Act provide for the regulation of numerous additional compounds, in addition to the pollutants regulated by the National Ambient Air Quality Standards. However these new provisions focus on the amount of permitted emissions from the most common emission sources of these compounds rather than the concentrations in the ambient air. While a passive, exposed soil surface or roadway is a potential regulated source, it will be many years before federal regulations are proposed for such a source, if ever. In the meantime, no standards exist in the federal regulatory scheme for these additional compounds in a circumstance as presented by this site.

Standards have been recently adopted by both the state (WAC 173-460) and local (PSAPCA Reg III) air agencies for these additional compounds. While an exposed soil surface or roadway is not included in the sources covered by the regulations, the regulations do provide ambient air quality guidelines that could be used to evaluate the estimated concentrations from the dispersion modeling. These guideline concentrations, termed Acceptable Source Impact Level (ASIL) have been established for several hundred compounds. The one of most interest for this study is the polynuclear aromatic hydrocarbon (PAH) class of compounds. This class specifically includes benzo[a]pyrene, benz[a]anthracene, benz[b]-anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, chrysene, dibenz[a,h]anthracene, and indeno[1,2,3 cd]pyrene. The current ASIL for this class is 6.0×10^{-10} g/m^3. No ASIL have been established for the individual compounds in this class.

The ASIL are used in evaluating the proposed controls on a potential source of VOC emissions. If modeling shows the controlled source will result in ambient concentrations everywhere less than the ASIL, then no further studies are required. If the estimated maximum concentration is greater than the ASIL, a more detailed study, including a risk assessment, may be used to establish the appropriate level of control. The ASIL does not, by itself, constitute an ambient air quality standard.

2.0 AIR INVESTIGATION OBJECTIVES

The primary purpose of the air investigation for the STF Superfund site is to estimate the potential air emissions concentrations and deposition loadings at receptor sites representative of human exposure to determine if the site may cause or contribute to an exceedance of an ambient air quality standard and to aid in characterizing the potential risks to human health of the current site in its current condition.

The primary objectives of the air dispersion modeling are to locate the points of maximum concentration and deposition rate and to produce estimates of the concentration and deposition rate at those points, for comparison to ambient standards, and at such other locations as are needed for risk assessment.

The concentrations at the point of maximum concentration will be compared to the national ambient air quality standards for PM-10 (particulate matter less than 10 micrometers in diameter) and lead. Estimates for PM-10 must be made for annual and 24-hour averages and for lead for calendar quarter averages (e.g., January through March). Estimates of concentration and deposition rate at the maximum concentration point and for the risk assessment population centers should be made for particulate matter, lead, and benzo[a]pyrene (all associated with particulate matter) and for such organic compounds released as gases from the surface that are found to have significant emission rates.

A secondary objective of the air dispersion modeling is to confirm that air monitoring is not necessary at the site boundary. A preliminary dispersion model using only exiting soil concentration data is sufficient to estimate the magnitude of the expected atmospheric concentrations. If these estimates are sufficiently less than the air quality standards, monitoring to determine that these standards are not exceeded is not necessary.

3.0 CHEMICALS TO BE MODELED

Air emissions from the STF Superfund site will originate with the evaporation of any volatile and semi-volatile compounds that may be present in the soil and by the mobilization of particulate matter at the surface of the soil. The particulate matter could also carry metals and less volatile organic materials.

3.1 PARTICULATE MATTER

Undifferentiated particulate matter (dust) can become airborne by the action of vehicle wheels along the surface or by a sufficiently strong wind where the surface has been previously disturbed. Once airborne, the dust can be carried off the site by the wind. The distance the dust moves before it again falls to the ground will depend on its dimensions, with particles larger than 20 μm in diameter falling much more quickly than the smaller particles. Such dust is subject to the PM-10 and TSP ambient air quality standards. PM-10 will be modeled in this study. TSP will not be modeled directly because PM-10 is a better measure of the amount of the particulate matter that can be inhaled and is thus more applicable to any eventual risk assessment.

Measurements at the site have identified several metals in the soil. Among the metals identified as being in higher concentration than is common in average soils are lead, chromium, copper, zinc, cadmium, and mercury. Elevated lead concentrations were found in several areas across the site, while the other metals were recorded at elevated concentrations in far fewer samples. Because lead can be expected to be present in the dust in each of the specific areas modeled, it will be used in this preliminary study as an indicator. That is, the results for lead should be approximately linearly related to the results that would be obtained for other soil metals. Lead is modeled as a fraction of the TSP emissions as the lead standard is based on the TSP measurement.

3.2 OTHER CHEMICALS

3.2.1 Semivolatile Organic Compounds (SVOC)

Polychlorinated biphenyls (PCB) have been identified in the soils at the Tacoma Public Utility yards. However, since most of this area is covered by asphalt it is not likely to be a significant source. Therefore, PCBs will not be modeled in this preliminary study.

Benzo[a]pyrenes and a limited number of other polynuclear aromatic hydrocarbon (PAH) compounds have been identified in the soils at several locations on the site. The compounds which were identified in the *Final Work Plan* included naphthalene, fluoranthene, benzo[e]pyrene, chrysene, benzo[ghi]perylene, phenanthrene, dibenz(gh)anthracene, indeno[1,2,3-cd]pyrene, pyrene, acenaphthene, benz[a]anthracene, anthracene, benzo[a]-

pyrene, and benzo[b]fluoranthrene. These compounds will be modeled as a class in this study. Because these are semivolatile compounds it will be necessary to model both the particulate matter phase and the gas phase. By separately reporting the gas phase results, it will be possible to gain some indication of the potential importance of the volatile organic compounds.

3.2.2 Volatile Organic Compounds (VOC)

VOC have been measured in some samples from the site. The source of these compounds has not been identified as they are not directly associated with any known previous uses of the site. The highest measured concentrations of VOC are reported in Table 1. These samples were collected in the top 0.5 meters of soil.

Because the gas phase of PAH compounds is being modeled, no VOC will be modeled in this study. Because the estimated concentrations scale directly to the emission rates, the magnitude of the estimated gas phase emissions of PAH compounds can be compared to any estimated VOC gas phase emissions to obtain a measure of the expected ambient concentrations.

Table 1. Concentrations of VOC

Compound	Highest Conc. (ppm)
Methylene Chloride	0.053
1,1,1 Trichloroethane	0.55
Tetrachoroethylene	0.30
Trichlorofluoromethane	0.01
Benzene	0.003
Toluene	0.01
Xylenes	5.9
Ethyl Benzene	0.8
Acetone	0.03

Data from Appendix Table D-2 of *Final Work Plan* (ICF, 1990)

4.0 EMISSION INVENTORY

Estimates of concentrations at receptor locations off-site first require an estimate of the rates at which particulate matter may become air-borne at the site and the concentrations of lead and PAH in the particulate matter. As PAH also is released from the soil as a gas, it is necessary to also estimate the rate of this gas release.

4.1 METHODS FOR ESTIMATING EMISSIONS

4.1.1 Particulate Matter

The primary sources of particulate matter that could become airborne are roadways and areas of unvegetated soil on the site. These sources can be modeled by treating as specific sources the roadways and each portion of the site where bare, erodible soil is evident. If the source areas are large, they can be divided into smaller areas that are each consistent in the measured concentration of the material (e.g., lead) being modeled.

Quite different procedures are necessary for calculating dust emissions from roadways and from exposed soil surfaces. The amount of dust that will be blown off of a roadway is primarily determined by the type and amount of traffic and the amount of fine dust on the road. The amount of dust blown off exposed soil surfaces is primarily determined by the amount of dust on the surface, the size of the material on the surface, and the maximum wind speed.

Wind Erosion Potential

The wind erosion potential of an exposed soil surface is highly dependent on the wind speed at the very surface of the soil. Thus any objects on the surface which serve to break or block the wind will reduce the wind speed at the actual surface and reduce the amount of material that will become airborne. Both vegetation and rocks on the surface will reduce the wind speed. Because of its size and density of growth, heavy surface vegetation will effectively prevent any significant wind erosion at any reasonably expected wind speed. But even moderate-sized rocks will provide sufficient roughness to the surface that a substantial wind is necessary before any dust will become airborne. As will be seen, this can mean that for many locations no fugitive dust will be blown off during a normal year.

In addition to wind speed, wind erosion is a function of the type and amount of available particulate, the soil characteristics, the amount of moisture in the soil, the ratio of area occupied by nonerodible elements, and the frequency of physical surface disturbances.

A standard procedure for calculating the rate of dust emissions from a limited erosion surface is described in *Compilation of Air Pollutant Emission Factors* (EPA, 1989). This method is based on a calculation of the highest daily wind speed (momentary, not hourly average) at the surface and a threshold velocity (again at the surface) above which some material will become airborne. The potential emissions during a high wind event from a dry, exposed surface are estimated from the equations:

$$E = 58(u^* - u_t^*)^2 + 25(u^* - u_t^*)$$
$$E = 0 \text{ for } (u^* \leq u_t^*) \qquad (1)$$

Where:

E = emissions from surface on day with wind above the threshold, g/m^2.

u^* = wind speed calculated at surface, m/sec

u_{t*} = threshold wind speed at surface for soil removal, m/sec.

When an above threshold wind event occurs, the dust is removed from the ground surface and will not again be available to an above threshold wind until the limited reservoir of dust is reestablished. Ultimately new soil is created by the breakdown of rock and other crustal materials by rain action. Rainfall also breaks the crusted surface to make fresh material below available. However, in the short run, physical disturbances which result in the exposure of fresh surface material can be more important (EPA, 1985).

At this site, rainfall tends to reduce emissions because the most significant limited erodibility sources are abandoned roadways. Because of their crowned shape they would be more likely to shed than collect water. For this reason rainfall is not considered as a physical disturbance. In addition, the equation was not developed with rainfall as an assumed disturbance (Schaum and Muleski, 1991).

The principal physical disturbance of the modeled sites (i.e., Madison and 50th) was assumed to be pedestrian trespass. It was assumed that individuals would walk one way along the length of the source once a week. Each person was assumed to take one step every 0.75 meters and the disturbance area for each step was estimated to be 130 cm^2. The disturbances were calculated on a statistical basis, i.e. the emissions were factored by a disturbance rate of 0.14 per day (52/365) and an area ratio which was the ratio of the disturbed area to total area for each disturbance episode. If the potential emissions for the disturbed area were not blown off because the wind that day did not exceed the threshold or more than 0.25 cm of rain fell, then the chance of a disturbance would accumulate. The accumulation would reset after the next time the wind speed exceeded the threshold and the dust was blown off.

The procedure for calculating the rate of dust emissions from an unlimited erodibility surface is described in *Rapid Assessment of Exposure to Particulate Emissions from Surface Contamination Sites* (EPA, 1985). This method is based on the average wind speed for each day and a threshold speed at anemometer height. The potential emission during a high wind event is given by the equation:

$$E = (0.036 * (1-V) * (u/u_t)^3 * F(x) \quad (2)$$

Where:

- E = emissions on day with wind above threshold, $g/m^2/hr$
- V = fraction of surface covered by continuous vegetation
- u = mean daily wind speed, m/sec
- u_t = threshold concentration of wind speed at 7 meters, m/sec
- $F(x)$ = empirical function of u_t/u

In this study only sites without any vegetative cover were modeled. The remaining areas were almost uniformly completely covered with vegetation. Thus V was always set equal to zero for the modeled area.

The empirical function F(x) is given in Figure 4-3 of *Rapid Assessment . . .* (EPA, 1985) for values of x less than or equal to 2 and in Appendix B of the same document for values of x greater than 2. For analytical convenience these functions were approximated by the two equations:

$$F(x) = -0.474x^2 + 0.055x + 1.978 \text{ for } x \leq 2$$
$$F(x) = 0.18(8x^3 + 12x)\exp(-x^2) \text{ for } x > 2 \quad (2')$$

The mean daily wind speed is taken from the Monthly Climatological Data Summary (National Oceanic and Atmospheric Administration) for the appropriate time period. For 1981 this value ranged from 0.98 to 8.8 m/sec.

The threshold wind speed for a given soil erosion area is estimated in both the limited and unlimited cases by measuring the size distribution of the particles that are on the surface of the soil. The measured mode in the size distribution is then compared to soils which were used in field determinations of actual threshold velocity. The calculated values of the threshold velocities for each area are provided in Section 4.3.

The limited erodibility model results in no emissions on days when the windspeed is below the threshold velocity while the unlimited model only approaches zero as the average daily windspeed approaches zero. The emissions on days when the windspeed is above the threshold velocity will vary from day to day, depending on the daily windspeed. Few, if any, meteorological dispersion models are able to accept daily variations in emissions. Generally this will require the model to be run separately for each day to obtain concentration estimates.

Particle size distributions for the surface dust at the South Tacoma Field Superfund site will be measured during the Phase I soil investigation. This preliminary study used the size distributions assumed for fugitive dust emissions in *Compilation of Air Pollutant Emission Factors* (EPA, 1989), Section 11.2.7. For PM-10 estimates, two particle size classes with mass median diameters of 5.0 and 0.5 μm were used. The mass fraction in these two classes was taken as 0.6 and 0.4, respectively. For lead and PAH estimates, four particle size classes of 21.2, 12.2, 5.0, and 0.5 μm, with fractions of 0.4, 0.1, 0.3, and 0.2 were used.

Vehicle Sources

Two equations presented in *Compilation of Air Pollutant Emission Factors* (EPA, 1989) were used to estimate emissions from vehicle travel over roadways. An equation developed for paved urban road was used for Proctor itself and equation for unpaved roads was used for the two parking areas. Equations for industrial paved roads were not used as, first, the majority of the traffic is passenger cars or light trucks and, second, a measurement of the silt loading on Proctor found it to be outside the range of concentrations (< 2 grams/m^2) which had been tested in developing the equation.

The equation for unpaved roads is:

$$E = k*1.7*(s/12)*(S/48)*(W/2.7)^{0.7}*(w/4)^{0.5} \qquad (3)$$

Where:

- E = emission in kg per vehicle kilometer traveled
- k = constant based on particle size
- s = silt content, % of road surface dust < 75 μm
- S = mean vehicle speed, km/hr
- W = mean vehicle weight, Mg
- w = mean number of wheels.

This equation is linear in the number of vehicle movements along the unpaved section of road, the mean vehicle speed, and the amount of dust on the roadway. For vehicles observed using these roadways, a reasonable estimate of the mean vehicle speed is 25 kph, the mean vehicle weight 2.5 tonnes, and the mean number of wheels 4. The measured silt content is reported for each area in Section 4.3. The constant k is given as having the value 1 for TSP and 0.36 for PM-10 emission estimates.

The equation for paved roads is:

$$E = K\,(sL/0.5)^{p} \qquad (4)$$

Where:

- E = emission in kgs per vehicle kilometer traveled
- K = constant based on particle size
- sL = road surface silt loading, g/m^2
- p = dimensionless exponent based on particle size.

The constant K is given as having the value 5.87 for TSP and 2.28 for PM-10 emission estimates. Similarly, the constant p is 0.9 for TSP and 0.8 for PM-10 emission estimates. The measured silt loading is reported in Section 4.3.

The dispersion models used for this report require a size distribution of the particulate matter on the roadways. A different size distribution is necessary when modeling PM-10 and when modeling lead as the lead sampling method collects the TSP-sized particles. Similarly, the TSP size classes were also used in modeling PAH. A different size distribution is required when modeling paved and unpaved roads.

The particle size distributions are provided in *Compilation of Air Pollutant Emission Factors* (EPA, 1989). The particle size factors for PM-10 and TSP for unpaved roads were taken from Section 11.2.1 and for PM-10 and TSP for paved roads from Section 11.2.5. For PM-10 from unpaved roads there are three size classes, with median diameters of 7.1, 3.53, and 0.5 μm diameter and fractions of 0.44, 0.30, and 0.26, respectively. For PM-10 from paved roads there are two size classes, with median diameters of 5.0 and 0.5 μm and fractions of 0.584 and 0.416, respectively. The PM-10 daily estimates for unpaved roads were calculated using only the two classes for paved roads. A comparison of results presented in Section 9.3 justifies this assumption as causing only an insignificant error.

For TSP (used for lead and PAH) from unpaved roads there are six particle size classes with median diameters of 47.4, 21.2, 12.2, 7.1, 3.5, and 0.5 μm. The mass fractions were 0.20, 0.30, 0.14, 0.16, 0.105, and 0.095, respectively. For TSP from paved roads there are four classes with median diameters of 33.5, 12.2, 5.0, and 0.5 μm, with fractions of 0.596, 0.04, 0.223, and 0.141, respectively.

4.1.2 Gaseous Chemicals

The volatile and semi-volatile compounds in the soil will evaporate into the air above the site through a classic mass transfer process. Their rate of transfer is dependent on the concentration of the chemical and the physical properties of the chemical and the soil.

The soil concentrations were estimated from previous measurements for this preliminary study . The physical properties and soil temperatures were obtained from the literature. The gas phase concentrations and the gas-phase mass transfer coefficients were estimated following the procedures described by Hwang, Falco, and Nauman (1986).

$$N_a = 2*E*D_{ei}*H/K_d*C_s/(3.14*alpha*T)^{0.5} \qquad (5)$$

Where:

$$alpha = D_{ei}*E/(E+P_s*(1-E)*K_d/H)$$

N_a = gas phase emission flux, grams/cm^2/sec
E = soil porosity, unitless
D_{ei} = effective diffusivity, cm^2/s
C_s = concentration of PAH in soil, g/g
H = Henry's Law constant, atm-m^3/mol
T = exposure interval, seconds
K_d = soil/water partition coefficient, unitless
P_s = true density of the soil, g/cm^3

4.2 SOURCES TO BE MODELED

The three areas which are of the most interest are the Amsted brass foundry property, the Dismantling Yard, and the swamp/lakebed area. During preliminary investigations, higher concentrations of metals have been measured in the soils of the Amsted property and the Dismantling Yard and higher concentrations of PAH have been measured in the Dismantling Yard and the swamp/lakebed area. As described in the *Air Investigation Plan* (Envirometrics, 1991), only these three areas will be modeled in this preliminary modeling study. It is expected that the mobilization of chemicals of interest from these three areas will be sufficiently similar to what could be expected from other areas on the site, that the modeling results can be generalized to the entire site.

The specific areas to be included in the model were determined, first, by reviewing the preliminary soil concentration data reported in the *Final Work Plan* (ICF, 1990) and, second, by an on-site inspection of the soil surface within these three general areas. The inspection revealed that most of the soil surface is covered with stable vegetation which would not permit soil to become airborne.

However some areas of bare soil were discovered and other areas, such as present or former roadways, were identified as sources that should be modeled.

Dust sources can be divided into three classes. The first is roadways and parking lots. The other two are areas of exposed soil surface. One is termed an "area of limited erodibility." That means the surface is a hard, crusty soil or is predominantly rock or other nonerodible material, so only a limited amount of soil is available at any one time to be blown off. Additional surface dust is created slowly, principally by a physical disturbance of the soil surface, so more will be available to winds on a latter date. The other is termed an "area of unlimited erodibility." A soil which is primarily finely divided, such as a sandy agricultural soil, will have new surface dust constantly available to be blown away. (EPA, 1985)

The specific source areas modeled within each of these three areas are shown in Figures 3 through 5. The sources included Proctor Street (six different line source segments) and two parking areas adjacent to Proctor Street, which are shown in Figure 3. Three wind erosion area sources on the Amsted property, Madison Street, and 50th Street (three different line sources) are shown in Figure 4. One area gas source covering the swamp/lakebed and five area gas sources covering the Dismantling Yard are shown in Figure 5. Also shown in these figures are the locations of the numbered receptors used in the modeling.

4.3 SOURCE CHARACTERISTICS

4.3.1 Amsted Property

The Amsted property is an approximately 225 meters by 150 meters rectangular area located in the south central portion of the site. The majority of the Amsted property is covered with vegetation, but immediately surrounding the former building site (the concrete slab is all that remains), there is an area of limited erodibility. Also a small area to the west of the former building site is an area of unlimited erodibility.

The area of limited erodibility is approximately 35 meters by 85 meters. The soil is crusted with loose material above. After removing material larger than 1 centimeter, the median size of the loose material was estimated to be approximately 2 millimeters based on the results of screening one sample area. The threshold friction velocity for the soil in this area was calculated to be approximately 30 meters per second at 10 meters above the surface. The silt loading on the crusted surface was measured at 116 grams per square meter (g/m^2). The friction velocity for this site was not exceeded during the 5 years which were modeled.

The area of unlimited erodibility is about 15 meters by 25 meters. This area is a fine sandy area on the west side of the clearing (the former building site). The median soil size was estimated to be about 70 micrometers. This gives a friction velocity of 4.9 meters per second at 10 meters above the surface.

Madison Street runs immediately west of the Amsted property. This roadway is closed to traffic although an occasional offroad vehicle or pedestrian may use the road. For modeling purposes it was assumed that two pedestrians transit the southern 365 meter section of road each week. The surface is crusted with loose material above. The median size of the

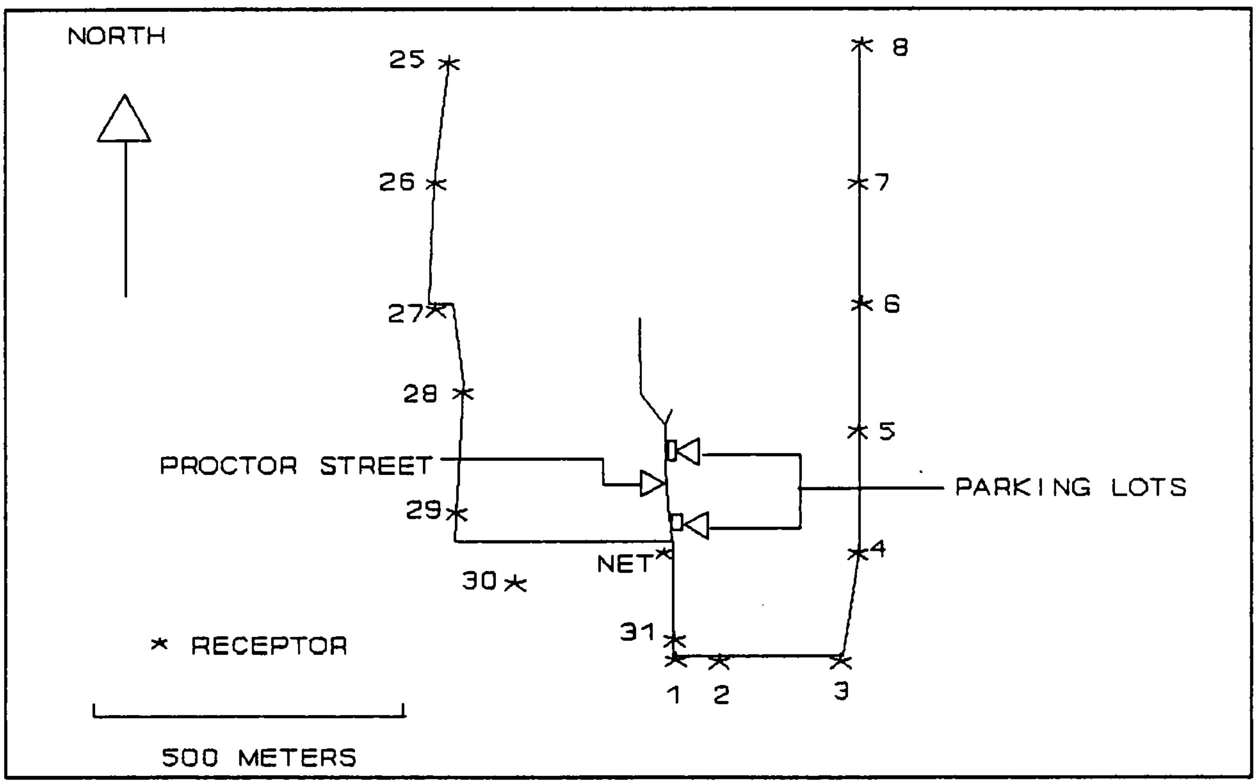

Figure 3. Locations of modeled particulate matter vehicle sources

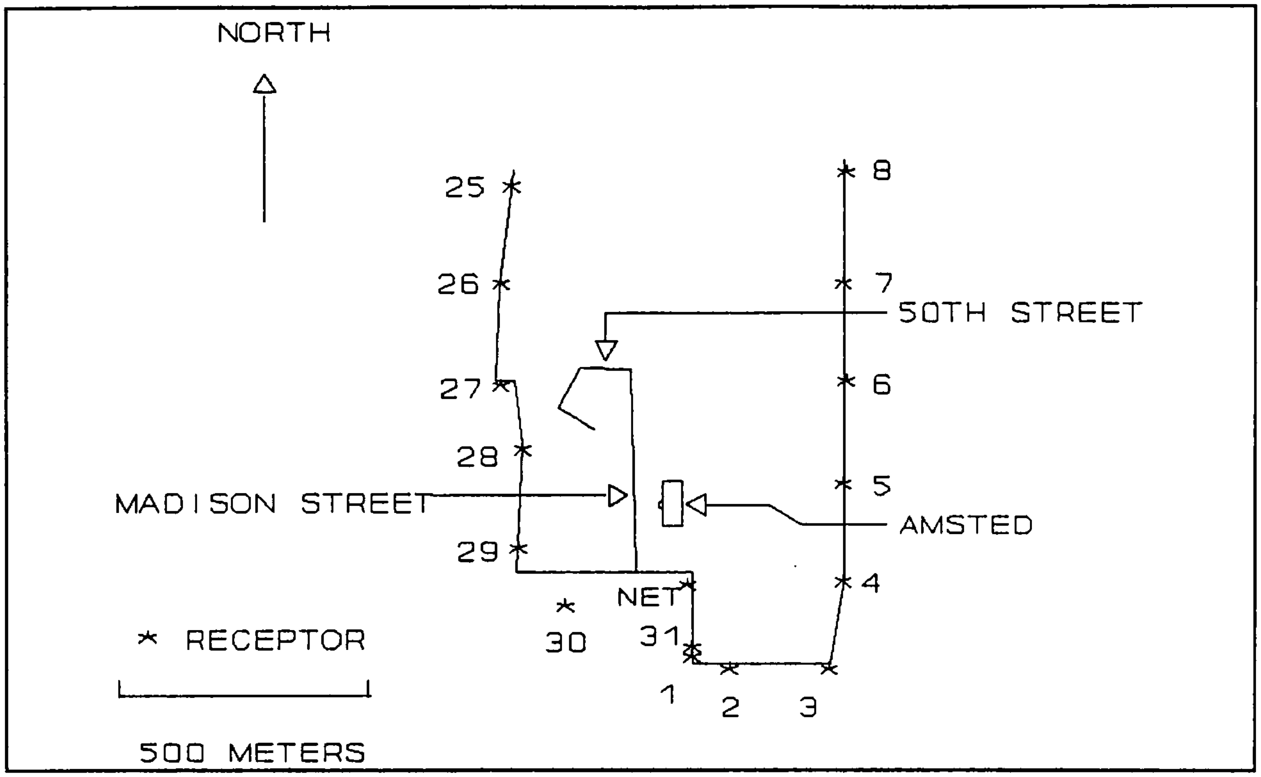

Figure 4. Locations of modeled particulate matter erosion sources.

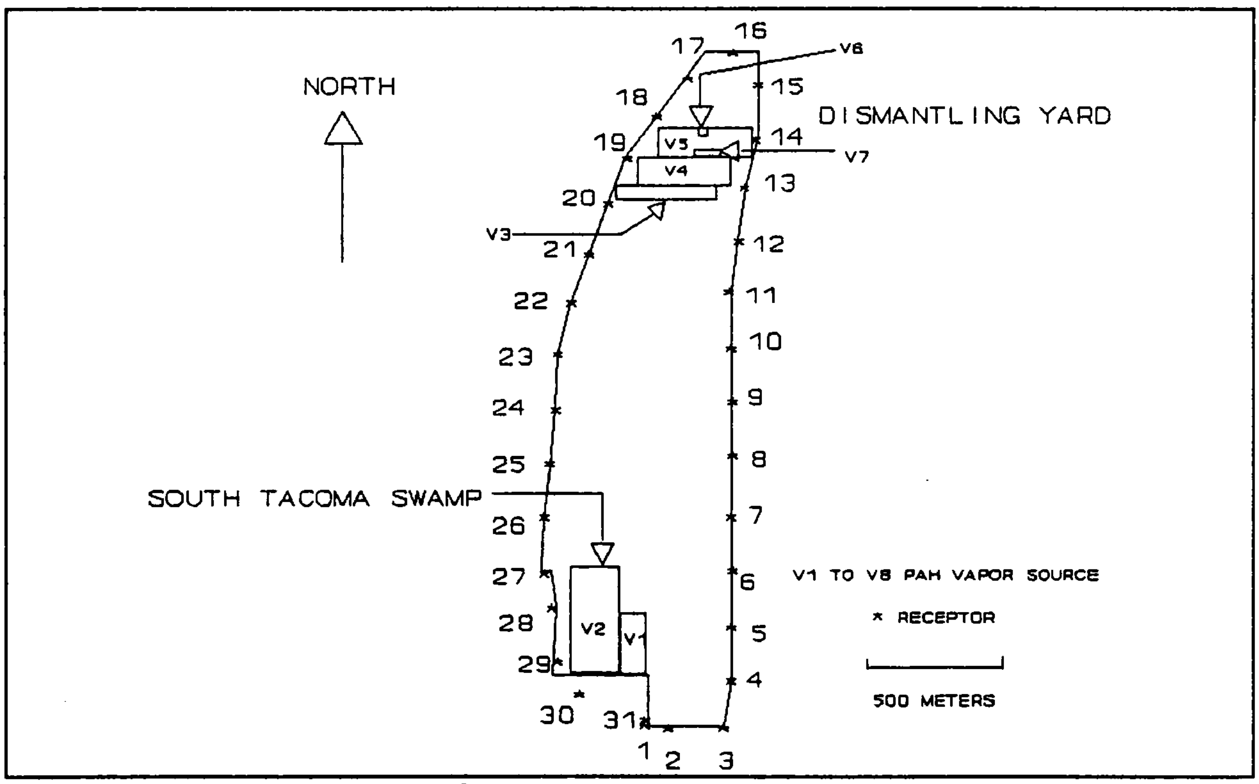

Figure 5. Locations of modeled vapor sources.

loose material was estimated to be approximately 225 micrometers based on the results of screening one sample area. The threshold friction velocity for the soil in this area was calculated to be approximately 12 meters per second at 10 meters above the surface. The silt loading on the crusted surface was measured at 355 g/m^2 for one sample area. This area was modeled as a single line source which was approximately 4.5 meters wide and 365 meters long.

Proctor Street runs immediately east of the Amsted property. Proctor is open to traffic and is used by employees and visitors going to and from the businesses on the TIP site. The maximum number of vehicles using the street was estimated to average 73 per day for a six day week. This estimate was based on a one day count of the number of vehicles in the parking lots and factoring for trips per day per vehicle (1.7) and for other visitors (1.1). This maximum number of vehicles traveling on Proctor occurs at the south end of Proctor since this is the only ingress and egress to the TIP property. The number of vehicles using Proctor decreases to the North. There are two parking areas on east side of Proctor on the TIP property at Savage Industries (approximately 350 square meters) and North Coast Electric (approximately 335 square meters). The road surface silt loading on Proctor was measured to be 0.91 g/m^2 while the silt content in the two parking areas was measured at 8.4 and 9.1 percent.

The erodible soil was assumed to contain both lead and PAH, both of which were estimated as a fraction of the total suspended particulate matter carried off the site. PAH were assumed to adhere to the soil and available for vaporization over the entire site.

4.3.2 Former Swamp/Lakebed

The former Swamp/Lakebed area is located at the SW corner of the site, bounded on the north by the now abandoned 50th Street and on the east by the Amsted property and the TIP area. The majority of the Swamp/Lakebed area is vegetated with thick grassy growth or blackberry bushes and a few trees. There are some areas of bare soil in the Swamp/Lakebed area near 50th Street, but they are very rough and cement-like with little or no erodible material on top of the crusted area.

Erodible material was found on 50th Street (and its extension to the south). For modeling purposes, it was assumed that two pedestrians transit the road each week. The surface is crusted with loose material above. The median size of the loose material was estimated to be approximately 225 μm based on the results of screening one sample area. The threshold friction velocity for the soil in this area was calculated to be approximately 7 m/sec at 10 meters above the surface. The silt loading on the crusted surface was measured at 61 g/m^2 in one sample area. This source was modeled as three 3 meter wide line sources which were approximately 95, 85, and 80 meters long.

The erodible soil was assumed to contain both lead and PAH, which were estimated as a fraction of the total particulate which could be emitted from the site. PAH were assumed to be contained in the soil and available for vaporization over the entire site, although no available data support this very conservative assumption.

4.3.3 Dismantling Yard

The Dismantling Yard is almost totally covered with vegetation. There are some areas around the railroad tracks which do not have vegetative cover, but even in these areas much of the surface material is greater than 1 cm in diameter. This would require unreasonably high velocity winds before any dust could become airborne. There are several other small areas within the Dismantling Yard which are bare but these areas are also rocky and/or crusted with little erodible material available. Therefore no dust emissions were estimated for the Dismantling Yard.

Since there is no vehicle activity or erodible soil, no particulate (including particulate-bound lead and PAH) emissions were modeled for this area. PAH were assumed to be present in the soil and available for vaporization over the entire site. Two smaller sub-sites were identified as potentially having very high concentrations of PAH. The Dismantling Yard was modeled as five different area sources which cover most of the site.

4.4 EXISTING SOIL CONCENTRATION DATA

Existing soil chemical concentration data were used in this preliminary modeling because characterization of STF surface soils was not complete at the time this report was being prepared. In general, these data were obtained during previous investigations that were aimed at identifying "hot spots" or characterizing areas of obvious contamination. They are likely to represent near maximum concentrations. But the sampling objectives, analytical methods, and quality assurance for these existing soil data varied with the different investigators. In addition, data were not available for all chemicals in all source areas, requiring concentrations from other source areas to be used where data were unavailable. Therefore, concentrations used for source areas during this preliminary modeling can reasonably be expected to reflect worst case conditions. The locations of the soil concentration data samples used in the modeling is shown in Figure 6.

Surface soil samples are being collected at approximately 650 locations during the Phase I Soil Investigation and are being analyzed for metals, boron, and PAH. Approximately 20 percent of these (130 samples) will be analyzed for VOC, SVOC, pesticides, and polychlorinated biphenyls (PCB). If additional air dispersion modeling is required for this site, these data will be available and could be used.

4.4.1 Amsted Property

Lead concentrations for fugitive dust from the Amsted property were estimated from surface concentration measurements reported in *Final Work Plan* (ICF, 1990). The concentration was calculated as a geometric mean of 5 measurements (SS-1, SS-2, SS-3, SS-5, Slope) which gave a concentration of 81,000 ppm. These concentrations were found in the vicinity of the old foundry and represent maximum concentrations from areas of obvious contamination.

The estimated concentration of PAH on the Amsted property was based on one sample (CBS-34 - ICF, 1990). This sample was collected on the south edge of the Amsted property. The concentration of PAH was determined by adding the concentration of the following individual compound concentrations: fluoranthene, benzo[e]pyrene, chrysene, benzo[ghi]perylene, phenanthrene, dibenz[gh]anthracene, indeno[1,2,3-cd]pyrene, pyrene, acenaphthene, and benz[a]anthracene, anthracene, benzo[a]pyrene, and benzo[b]fluoranthrene. The total comes to 16 ppm.

The concentrations of lead and PAH on the adjacent road and nearby parking lots were assumed to be the same as on the Amsted property because no other data were available for these areas. These concentrations are more likely to be higher than the actual concentrations.

4.4.2 Former Swamp/Lakebed

Lead concentrations for fugitive dust from the swamp/lakebed area were estimated to be the same as the lead concentrations on the adjacent Amsted property because there were no lead concentration measurements available for the site. The lead concentration which was used for modeling was 81,000 ppm. This is no doubt a conservative estimate (i.e. the concentration in this area is probably considerably lower).

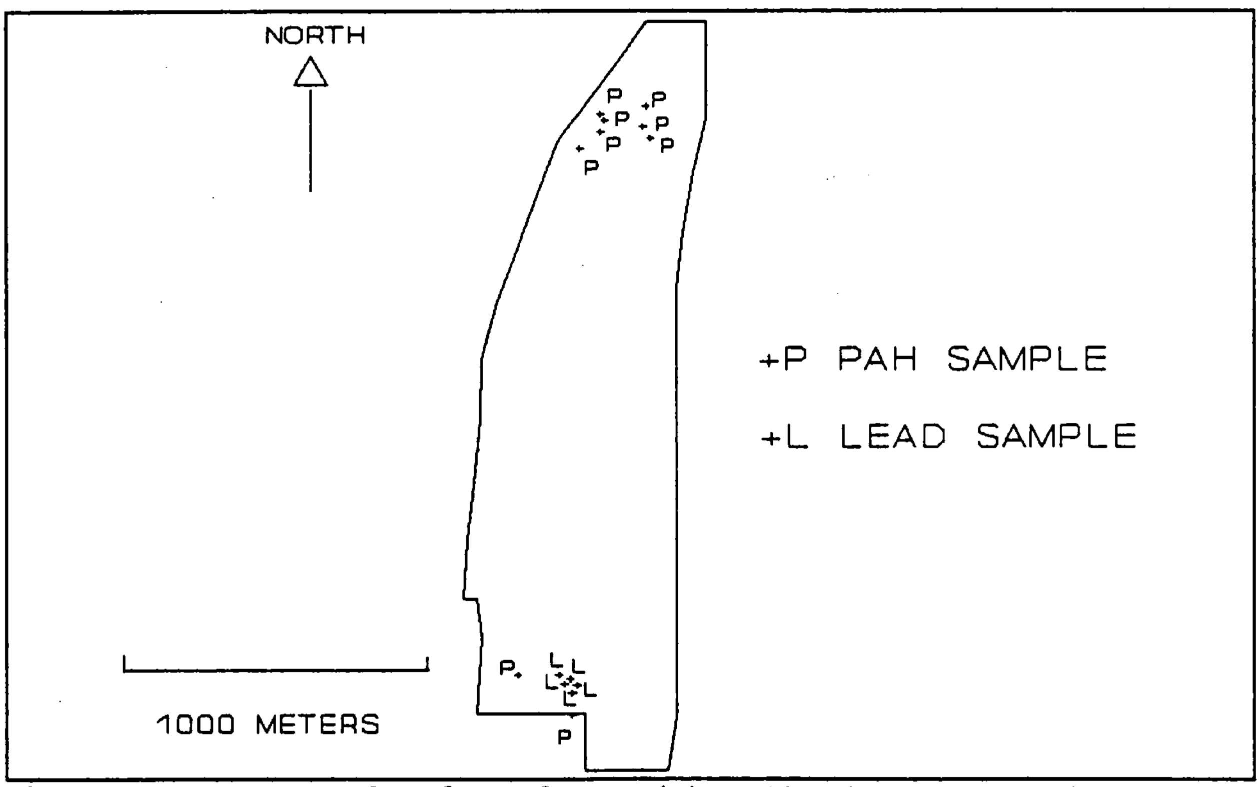

Figure 6. Locations of soil samples used in estimating concentrations.

Only one appropriate PAH measurement is available in the swamp/lakebed area (CBS38, see Figure 1-16 in ICF, 1990), which was approximately in the center of the area. The reported value was 15.5 ppm. Other tests (27-32 and 27-44) reported in the *Final Work Plan* (ICF, 1990) identified total base-neutral-acid (BNA) compounds, which would include the PAH but likely includes many other compounds as well. Therefore these concentrations were not used, although the total BNA were of the same order of magnitude as the total of the reported PAH from CBS38. CBS38 was used for the concentration in the dust on Madison and 50th Street as well as the gas phase emissions from the Swamp/Lakebed area.

4.4.3 Dismantling Yard

Lead concentrations were not estimated for the Dismantling Yard as there were no particulate sources in that area.

The concentration of PAH for the gas phase emissions from the Dismantling Yard was estimated from the geometric mean of samples S-1, S-2, S-3, S-4, and S-5 (ICF, 1990) as 9.3 ppm. This assumes that the actual concentration is in the part per million range and not part per billion, as was reported in the *Final Work Plan* (ICF, 1990). The original lab report (Tacoma-Pierce County Health Dept., 1986) reported the PAH concentrations for sample SB4 and SB5 for the gas chromatography/mass spectrometry (GC/MS) analysis as parts per million. Since there appears to be some question regarding the actual concentrations in this area, a conservative approach was taken until more data are available.

Samples S1 through S5 were collected across the northern half of the Dismantling Yard site. Samples SB4 and SB5, taken from two small areas, reported concentrations of 14,000 ppm and 19,000 ppm, respectively, but these samples were analyzed with a screening procedure which is not specific for PAH. The actual lab report (Tacoma-Pierce County Health Dept., 1986) suggests that the concentration of PAH was 10 to 100 times less than the reported results. A GC/MS analysis on these same samples also suggests the concentrations of PAH were a factor of approximately 1/300th of the percent range concentrations reported. As a very conservative estimate (i.e., worst case situation), the two small areas which were sampled and reported as having the highest PAH concentrations were modeled with assumed concentrations of 1900 ppm and 1400 ppm (10% of the reported concentrations). These two areas were modeled as an overlay on the base area with its own PAH concentration of 9.3 ppm.

4.5 EMISSION RATE ESTIMATES

4.5.1 Particulate Matter

Preliminary soil and road dust samples were collected at each of the potential particulate emission locations: 1) Burlington Ave., 2) just south of General Plastics, 3) the unpaved parking lot just south of Pioneer Building Supply, 4) on Proctor Street south of Savage Industries and north of Northcoast Electric, 5) on Madison street approximately one third of the distance north from the site boundary to 50th street, 6) and on 50th street about 60 meters west of Madison.

The measurements were made using a small broom and a dust pan, collecting all the material that could be brushed away within a fixed area. These samples were later screened with the following sieves sizes: 3.35 mm, 300 μm, 150 μm, 75 μm, and a pan to catch any silt less than 75 μm.

The modeled parking lots' silt loadings were based on measurements made at the unpaved parking lot just south of Pioneer Building Supply. The percent silt used in modeling of the paved surfaces, given in Section 4.3, is consistent with literature values. Table 2 reports the calculated emission rate for Proctor and the two parking lots adjacent to Proctor. The length of Proctor and the areas of the parking lots are given in the table. The estimates for lead and PAH are calculated by multiplying the TSP emission rate by the soil concentrations given in Section 4.4.

The estimated emission rates of fugitive dust were calculated for each source area for each day using the equations, assumptions, and data described in Sections 4.3 and 4.4. The emissions vary from day to day since both the wind speed and the accumulated disturbance fraction will change. Table 3 reports the maximum calculated emission rate for each source area for each of the five years modeled and the number of days in that year when any emission occurred. The estimates for lead and PAH are based on soil concentrations discussed in Section 4.4.

The calculation of the friction velocities for the erosion sites were based on the estimated modal size of the soil. This was estimated to be 1950 μm for the Amsted property limited reservoir site (the larger of the two Amsted property sites), 225 μm for both 50th Street and Madison street, and 160 μm for the Amsted property unlimited reservoir site. This

Table 2: Particulate Matter Emission Rates for Vehicle Sources

			g/sec	length/area
PM-10	24hr	Proctor St.	9.96E-4	400 meters
		Parking Lots	3.30E-3	777 sq. meters
PM-10	Annual	Proctor St.	5.19E-4	400 meters
		Parking Lots	1.75E-3	777 sq. meters
Lead	Qrtly	Proctor St.	9.47E-5	400 meters
		Parking Lots	3.0E-4	777 sq. meters
PAH	Annual	Proctor St.	2.33E-8	400 meters
		Parking Lots	7.25E-8	777 sq. meters

Table 3. Maximum Particulate Matter Erosion Emission Rates by Source

PM-10

Year	Amsted(L)[1] ($g/m^2/sec$)	Date	Amsted(U) ($g/m^2/sec$)	Date	Madison[2] (g/m/sec)	Date	50th[3] (g/m/sec)	Date
1978	0	1978	3.09E-6	12-14-78	0	1978	1.69E-7(38)[4]	11-04-78
1979	0	1979	2.06E-6	3-09-79	0	1979	2.23E-7(44)	12-24-79
1980	0	1980	1.52E-6	1-26-80	0	1980	3.01E-7(29)	04-15-80
1981	0	1981	3.81E-6	4-09-81	1.60E-6(5)	4-09-81	9.40E-7(65)	04-09-81
1987	0	1987	3.09E-6	2-23-87	0	1987	5.96E-7(39)	11-20-87

Lead

Year	Amsted(L) ($g/m^2/sec$)	Date	Amsted(U) ($g/m^2/sec$)	Date	Madison (g/m/sec)	Date	50th (g/m/sec)	Date
1978	0	1978	5.02E-7	12-14-78	0	1978	2.74E-8	11-04-78
1979	0	1979	3.35E-7	3-09-79	0	1979	3.63E-8	12-24-79
1980	0	1980	2.47E-7	1-26-80	0	1980	4.89E-8	04-15-80
1981	0	1981	6.18E-7	4-09-81	2.59E-7	4-09-81	1.53E-7	04-09-81
1987	0	1987	5.02E-7	2-23-87	0	1987	9.68E-8	11-20-87

PAH

Year	Amsted(L) ($g/m^2/sec$)	Date	Amsted(U) ($g/m^2/sec$)	Date	Madison (g/m/sec)	Date	50th (g/m/sec)	Date
1978	0	1978	1.0E-10	12-14-78	0	1978	5.2E-12	11-04-78
1979	0	1979	6.7E-11	3-09-79	0	1979	6.9E-12	12-24-79
1980	0	1980	4.9E-11	1-26-80	0	1980	9.3E-12	04-15-80
1981	0	1981	1.2E-10	4-09-81	4.9E-11	4-09-81	2.9E-11	04-09-81
1987	0	1987	1.0E-10	2-23-87	0	1987	1.8E-11	11-20-87

1 Amsted(L) is the Amsted site with limited erosion potential. Amsted(U) is the Amsted site with unlimited erosion potential.
2 Width of Madison is 15 feet.
3 Width of 50th is 10 feet.
4 Number of days with any erosion emissions during that year. Amsted(U) emissions occur every dry day.

size then determines the friction velocity at approximately ground level. The ratio of the area occupied by soil and debris larger than 1 centimeter to the total area sampled was also measured. This ratio is required to estimate F(x).

4.5.2 Polynuclear Aromatic Hydrocarbons

Particle phase PAH emissions were estimated from the concentration fraction measured in the soil and the particulate matter emission rates described in the previous section. The calculated particulate matter emission rates for each of the source areas are given in Tables 2 and 3.

Gas phase emissions were estimated from the equation given in Section 4.1.2. The soil porosity was assumed to be 0.3 and the density of the soil was assumed to be 2.86 g/cm^3 (EPA, 1988). The diffusivity in air and Henry's Law constant were based on benzo[a]pyrene. Values of D_{ei} = 0.029 cm^2/sec and H = 1.4E-9 atm-m^3/mol were obtained from cite (EPA, 1990). The exposure interval is one year.

Means et al. (1980) suggest the equilibrium Freundlich constants (K_d), linear partition coefficients (K_p), and the linear partition coefficient normalized for organic carbon content of the soil (K_{oc}) be used to predict the octanol-water partition coefficient.

Specifically,

$$\text{Log } K_{oc} = \text{Log } K_{ow} - .317$$

and

$$K_d = K_p = K_{oc} * \text{ratio of organic carbon.}$$

Thus Log K_{ow} and an estimated ratio of organic carbon can be used to calculate the K_d. The K_{ow} used was taken as 1,030,000 (McCarthy, 1985). The estimate of the organic carbon ratio was 1% (as used by Means et al., 1980). This yields a value for K_d of approximately 5,000.

The calculated gas emission rates and the areas for each of the seven PAH gas areas are given in Table 4.

Table 4: Emission Rates for Vapor Source Areas.

		g/sec	area
Amsted	(V1)	4.9 E-8	21,400 m^2
Swamp/Lake Bed	(V2)	1.52E-7	69,700 m^2
Dismantling Yard	(V3)	2.53E-8	19,400 m^2
	(V4)	4.45E-8	34,100 m^2
	(V5)	4.84E-8	37,100 m^2
	(V6)	2.03E-7	760 m^2
	(V7)	4.41E-7	2,259/m^2

5.0 METEOROLOGICAL DATA

The *Guideline on Air Quality Models* (EPA, 1990b) recommends the use of meteorological data collected on-site and, when it is not available, the use of nearby data collected by others to the same quality level as National Weather Service (NWS) data. Meteorological data are available from a nearby site operated by WDOE and from McChord AFB. The *Guideline* additionally recommends using five years of data to reduce the variability of year-to-year fluctuations in weather patterns. Data are available from the WDOE site from 1978 through 1987 and from McChord AFB for all those years and up to the present.

5.1 SOURCES OF METEOROLOGICAL DATA

Wind speed, wind direction, and ambient temperature are available from the Mt. Tahoma WDOE site, while cloud cover, ceiling height, and rainfall are available from McChord AFB. Missing hours of wind speed, wind direction, and temperature at Mt. Tahoma can be supplied by observations at McChord AFB while missing hours of cloud cover and ceiling height at McChord AFB can be supplied by observations at the SeaTac NWS site. Mixing heights are available from the Quillayute upper air soundings and SeaTac National Weather Service (NWS) site surface data. The SeaTac NWS site is located approximately 28 kms northeast of the STF Superfund site.

The Mt. Tahoma site was in an entirely open area about 460 meters south of the southern boundary of the STF Superfund site. The McChord AFB meteorological monitors are located in the open near the north and south ends of the runways, about 6 km south of the southern boundary of the site.

The McChord AFB data have received a quality assurance review by the U.S. Air Force comparable to the quality assurance review of data from NWS sites. The Mt. Tahoma data were not subject to a similar quality assurance review. To meet this requirement, a quality assurance review was conducted which concluded the five years of data from 1978 through 1981 and 1987 from the Mt. Tahoma site can provide a reliable meteorological data base for air pathways dispersion modeling (Envirometrics, 1991b). As summarized in Section 5.2, the remaining data was determined to be less reliable.

The stability class can be calculated from Mt. Tahoma surface data and ceiling height and cloud cover observations from McChord AFB using EPA's RAMMET program.

Mixing heights are calculated for the same period of record as the surface data using the Quillayute upper air soundings and SeaTac airport surface data by the National Center for Climatic Data.

5.2 QUALITY ASSURANCE REVIEW

The quality assurance review of the Mt. Tahoma data compared that data with the McChord AFB data using simple statistical analyses and visual inspection of windrose and frequency tables. Statistical analysis shows how well the readings at the two monitors are correlated but not which monitor is likely to be in error when the correlation is poor. To identify the source of the deviation from the long-term average it is easiest to visually compare windroses and frequency distribution tables for the sites.

The percentage of data available for each site for each year is provided in Table 5. Data recovery (the amount of data available in the record) is excellent for McChord AFB and Quillayute in all years, but several years at the Mt. Tahoma site are marked by long periods without data.

A Pearson correlation matrix was created for each year, 1978 through 1987, for Mount Tahoma and McChord AFB wind directions. The lowest Pearson correlation coefficients are calculated for the years 1984 through 1986. The average difference in wind direction was computed for each year. A positive 13.8 degree difference in direction was recorded between McChord AFB and Mount Tahoma in 1983 while a negative 30.7 degree difference was observed in 1985. Frequency tables identified the difficulty as a missing 22.5 and 45 degree winds anomaly.

Windroses were created for each season for each year for both Mt. Tahoma and McChord AFB. A comparison of the windroses shows a general agreement in wind direction between the two sites until the fourth quarter of 1984. From the fall of 1984 until the summer of 1986 the 22.5 (NNE) and 45 (NE) degree wind vectors almost disappear from the Mt. Tahoma windroses. In the summer of 1986 the 22.5 and 45 degree wind vectors from Mount Tahoma reappear.

The Envirometrics (1991b) review of the data concluded the wind direction and wind speed data from the Mt. Tahoma High School meteorological monitoring site

Table 5. Meteorological Data Recovery

Year	Mt. Tahoma	McChord AFB	Quillayute
1978	87%	98%	99%
1979	100%	99%	97%
1980	92%	100%	95%
1981	97%	100%	95%
1982 (1st half)	24%	100%	95%
1982 (2nd half)	94%	100%	97%
1983	98%	100%	96%
1984	98%	100%	98%
1985	95%	100%	98%
1986 (1st half)	89%	100%	94%
1986 (2nd half)	72%	100%	95%
1987	95%	99%	88%

for the years 1978 through 1981 and 1987 meet the quality assurance standards of an NWS site and can be relied on for air pollution dispersion modeling. The reason for the anomalous data at Mt. Tahoma from 1982 through 1986 was not determined, but it was concluded that data should not be used.

In deciding what data to exclude from use in air pollution dispersion modeling it is important to know if a year which is unusually high in stagnant air conditions has been discarded. An examination of the hours recorded as calm for each site for each year found the years proposed for exclusion, 1982 through 1986, did not have a higher average incidence of calms.

5.3 MISSING DATA ADJUSTMENTS

The air quality models used in this preliminary modeling study require data in each hour of each year. If an hourly wind speed or wind direction observation is missing, a substitute value must be provided before the model can be run. To complete the set, data from McChord AFB was substituted for the missing hours in the Mt. Tahoma record during acceptable years. However, there are a total of 66 hours in 1978 and 1 hour in 1979 when data were not recorded at either location. Because the periods of missing data at McChord are short, averages or bridges between the preceding and following hours were used to establish records for the missing hours. For the 2 periods of 6 to 9 hours, data from a nearby day with similar climatological characteristics during the same hours were used.

Since there is an observed shift in the wind direction between the two sites, four average offsets were calculated for quadrants centered on a north-south axis to transfer the data from McChord AFB to the Mt. Tahoma site. The offset was 7.6 degrees for north winds, 6.1 degrees for east winds, -10.6 degrees for south winds, and -5.6 degrees for west winds.

Wind speed data were transferred directly from McChord to Mt. Tahoma without adjustment.

Any missing data on cloud cover or ceiling height at McChord was filled with data from the SeaTac NWS site. Both variables are so consistent at the regional scale that this substitution is not expected to have had any impact on the stability calculations.

5.4 PREPARATION OF DATA FOR MODELING

All the valid data was processed by EPA's RAMMET meteorological preprocessor program. This program modifies the mixing height, randomizes the wind direction over a ten degree segment, calculates the stability class, and prepares the file for use with the EPA dispersion models. Urban mixing heights had a lower limit of 100 meters.

6.0 MODELING METHODOLOGY

6.1 MODEL SELECTION

A variety of models have been developed for the analysis of air dispersion. Screening models provide a quick but very conservative estimate of the ambient concentrations. Refined models utilize more detailed information in characterizing the situation and provide a better estimate of the concentrations. Beyond this first division, the primary considerations in selecting a model include the nature of the surrounding land use and terrain and the types of sources to be modeled.

6.1.1 Surrounding Terrain

When the terrain around a site is flat to gently rolling, modeling the air currents as moving in straight lines is a reasonable representation of reality. When the terrain rises above the site the air currents cannot flow in straight lines without running into the sides of the hills. In some cases they do run right into the hills but in other cases the air currents lift and flow over the hills, following the surface of the ground. This is determined by atmospheric conditions and the difference between the height of the source and the height of the terrain.

Some models are intended to be used only in situations where the terrain does not rise above the source, while others are designed for use with high terrain surrounding the source. In general, the models designed to be used with surrounding terrain allow the air currents to rise with the terrain when the atmosphere is unstable or neutral and to flow straight into the terrain when the atmosphere is stable. This means that in unstable or neutral conditions the height of the air currents above the ground remains constant but that in stable conditions the distance decreases to zero.

The hills that rise above the STF site reach a height of about 35 to 50 meters above the base of the valley, which is about 910 meters wide at the site. The site itself is about 670 meters wide, with the base of the hills on the west approximately at the property boundary. To the north of the site the valley turns and closes to about 365 meters in width while to the south of the site the valley opens to about 1500 meters wide.

Models that do not take terrain into account often allow receptors to be placed above the source's ground level at their own elevation, as if on a telephone pole. Thus they will properly model the situation that occurs when air current do not rise as they impact a hillside. It is also possible to set all receptors to a constant height, say 2 meters, so the model will properly model the situation that occurs when the air currents rise and travel over the terrain as if it were flat.

6.1.2 Surrounding Land Use Classification

Some dispersion models incorporate alternate parameters that take into account the greater dispersion that occurs in urban areas. Selecting the urban or rural coefficients requires a determination of the predominant local land use, based either on population density or an on-the-ground review of actual land uses.

The population density procedure is useful when the area is of a high enough density that this simple technique can clearly classify the area as urban. When there are highly industrialized or commercial areas within the 3 km circular analysis area the population density procedure will record an artificially low density and mislead to a rural definition even while the area is built up to an actual urban land use character.

Because the STF neighborhood does contain numerous sections of such industrialized and commercial land use, the actual land use procedure was utilized. As described by Auer (1978), if more than 50% of the land use in the 3 km circumscribed area around the center of the site is in industrial, commercial, or closely-spaced residential use, then the area should be classified as urban. This article carefully describes the physical characteristics of the areas that can be so classified. Suburban residential areas and parks, for example, are not within the urban classification.

The urban and rural classification areas within the 3 km circle were identified by City of Tacoma zoning code maps, topographic maps, and actual inspection. The on-the-ground inspection focused on the rapidly changing commercial areas along Highway 16, the apparently undeveloped areas on the maps, and the residential areas in the southern and eastern parts of the area, which might not have qualified as urban.

The distribution of urban and rural areas is shown in Figure 7. The portion that was classified urban totaled 55 percent of the circumscribed area. It is expected that a closer examination of the area would be more likely to yield areas that were classified here as rural that, following Auer, should be classified as urban, rather than vice versa.

6.1.3 Characteristics of Available Models

The models most commonly used for an urban valley location, such as the STF Superfund site, would be the Industrial Source Complex - Short Term (ISCST) model for the receptors on the valley floor and ShortZ/LongZ for the receptors on the valley walls. The *Air/Superfund National Technical Guidance Study* (EPA, 1989) recommends ISCST and the Point-Area-Line (cite) (PAL) model for situations similar to STF.

Another model which may be well-suited to this situation is the Fugitive Dust Model (FDM). Although not currently among the EPA recommended models, it was developed through EPA Region 10 and is well-understood and accepted in this regional office.

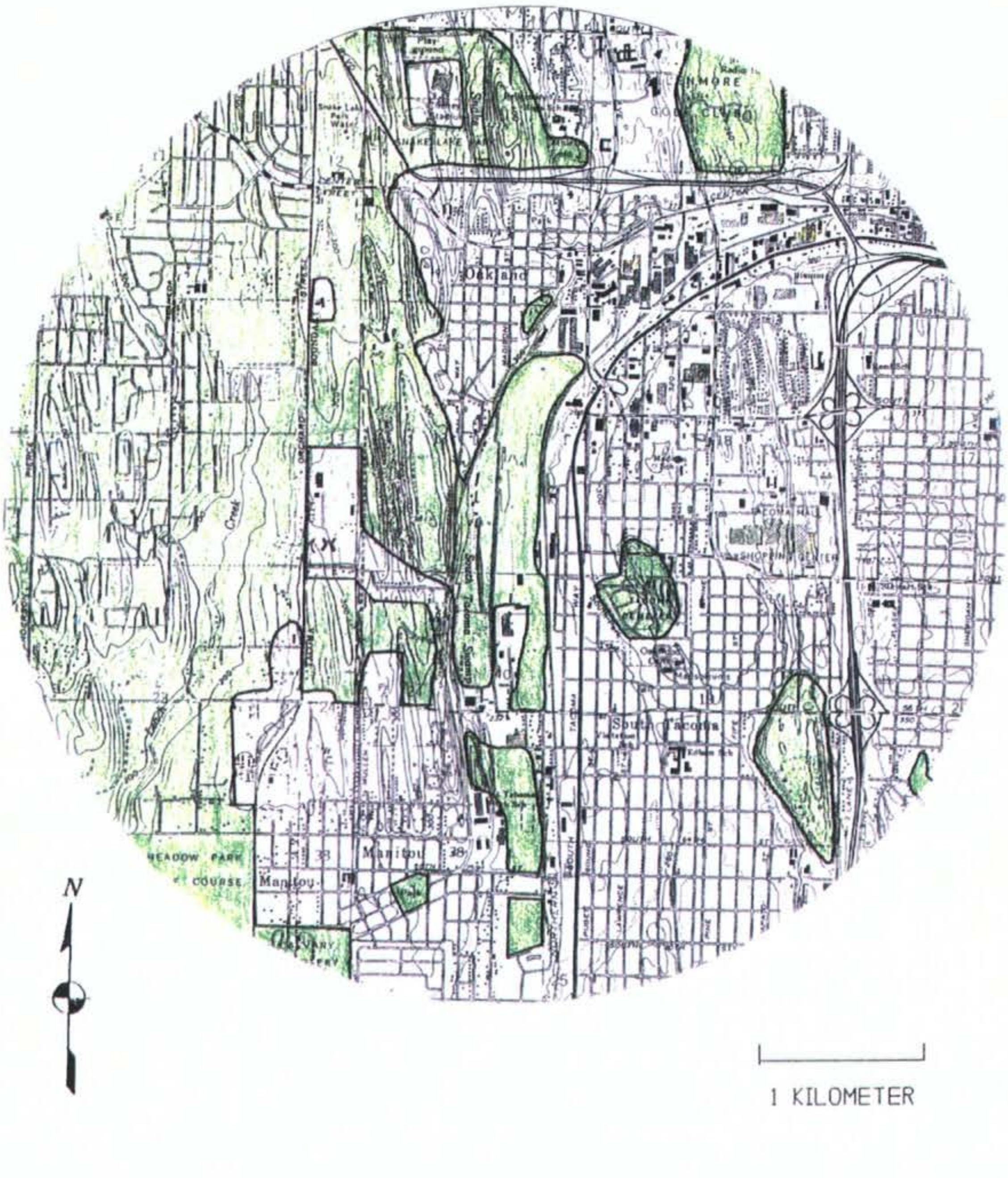

Figure 7. Urban/Rural land use patterns (shaded areas are rural)

The ISCST model (EPA, 1986b) is designed for flat terrain modeling, where none of the receptors are above the height of the source emission plume. It offers several calculation routines for use with stacks that are not found in the other models. Calculation of particle deposition is included. Both urban and rural dispersion coefficients are available. ISCST models area sources but not line sources, such as streets. If it were used, an additional line source model would have to be used.

LongZ/ShortZ (Bjorklund and Bowers, 1982) is recommended for modeling in elevated terrain, but it does not actually treat the air currents moving over the terrain any differently than ISCST, simply allowing air currents to run straight into a hillside. Urban and rural dispersion coefficients are available. Calculation of particle deposition is included. LongZ/ShortZ does not include a line source model.

The PAL model (Peterson and Rumsey, 1986) is intended for modeling in level terrain, with the air currents flowing smoothly over any hills. This will result in an appropriate calculation for unstable and neutral conditions. For stable conditions this will result in an overstatement of the concentration for receptors significantly above the plume and an understatement for receptors in or near the plume. Urban and rural dispersion coefficients can be used. A particularly good area source algorithm is used. PAL includes a line source model. Particle deposition is treated in a more complete fashion than in ISCST or in LongZ/ShortZ.

The FDM model (Winges, 1990) is designed for use in flat terrain areas. It uses only rural dispersion coefficients. Particle deposition is calculated so as to avoid many of the problems of earlier models. The area source algorithm is similar to the one used in PAL. Particle deposition is handled in a very sophisticated manner. FDM includes a line source model.

6.1.4 Preferred Models

The STF site includes an important road, which should be modeled as a line source. Although the site itself is rural, the surrounding land uses are predominantly urban. Particle deposition will be necessary if risk assessment modeling is necessary.

With these objectives, the best models appear to be the FDM model for use along the exterior borders of the site and the PAL model for receptors back away from the property boundary.

6.2 MODELING PROCEDURES

6.2.1 Fugitive Dust Model

Version 91070 of FDM was utilized. It was possible to run this model as supplied. Default values provided by FDM were accepted in most cases. Specifically, 1) the model computed deposition velocity and gravitational settling velocity from particle size information provided in the input gravity was set to 2.5, and 4) particle deposition was computed except for the PAH gases run where it was turned off. Rural mixing heights were selected from the meteorological data set.

FDM was run separately for each type of source term. The paved and unpaved vehicle sources and the erosion sources required different particle size distributions, but only one can be accepted for a single run. The specified size distribution was modified for one run to allow line and area sources to be run together. In Section 9.3 the resulting difference in concentration estimates is shown to be insignificant. In addition, the erosion sources required a different emission rate each day that an emission event occurred. Thus it was necessary to make 365 different runs for a year.

Because FDM reports a fixed number of decimal places it was necessary to enter the PAH emission rates as nanograms/sec, rather than as grams/sec as called out in the FDM manual, in order to produce any readable output. The results were converted to a common base through post-processing.

Output files were generated for the annual and the highest and second highest daily concentrations for each receptor for vehicle sources, separately for paved and unpaved streets, and for erosion sources for PM-10, highest quarterly concentrations for each receptor for vehicle and erosion sources for lead, and highest annual concentration values for each receptor for vehicle, erosion, and gas sources for PAH. These estimated concentrations were totaled and reported by a post-processing program:

The post-processing program read each FDM output file, found the concentrations for each receptor, added them, and reported a combined total estimated concentration for each receptor.

6.2.2 Point-Area-Line

Version 2.0 of PAL was utilized. Several modifications were necessary in order to run this model. The error function subroutine, which is available on most main frame computers, had to be added to the program code. The routine from the Association for Computing Machinery library was used. A coding error was corrected in the wind shear subroutine. This error has now been corrected by EPA in the most recent update of PAL. (Peterson, 1991). The settling and deposition velocity input was moved from Card Type 4 to Card Type 6 and Card Type 7 so different values could be used for different sources.

Default values provided by the PAL code were accepted in most cases. Specifically, 1) the wind shear modification to wind speed was calculated for both area and line sources but wind speed was not modified below 1 meter or above the anemometer height, 2) Briggs urban (McElroy-Pooler) dispersion coefficients were used, and 3) particle deposition was computed except for the PAH gas run where it was turned off. Urban mixing heights were selected from the meteorological data set.

The deposition and settling velocities used were those calculated for the same sources by the FDM model.

PAL was run separately for erosion and vehicle source terms. The erosion sources required different emission values on each day. One day is also the maximum time period that PAL will average concentrations. The results were accumulated to quarterly and annual averages through post-processing.

Output files were generated for the annual and the highest and second highest daily concentration values for each receptor for vehicle and erosion sources for PM-10, highest quarterly concentration values for each receptor for vehicle and erosion sources for lead, and highest annual concentration values for each receptor for vehicle, erosion, and gas sources for PAH. These estimated concentrations were totaled and reported by a post-processing program.

The post-processing program read each PAL output file, found the concentrations for each receptor, added them, and reported a combined total estimated concentration for each receptor.

6.2.3 Selection of Modeling Periods

A comparison of vehicle (Table 2), erosion (Table 3), and gas (Table 4) emissions shows the dominance of the vehicle emissions. Because the maximum vehicle emissions occur on low windspeed days and the maximum erosion emissions occur on higher windspeed days, a comparison was also made of actual concentrations on their respective maximum emission days. Concentrations from vehicle emissions were found to dominate the estimated concentration on the overall highest and second highest concentration days.

Vehicle concentration estimates were calculated for all five years of data for daily, quarterly, and annual periods. As will be described in Section 9, the maximum values were found to occur in 1981, with the maximum quarterly value in the first quarter. Erosion and gas concentration estimates were then run for 1981 and all the 1981 output files post-processed to obtain the maximum estimated concentrations.

7.0 RECEPTOR LOCATIONS

The sites selected for model receptor locations reflect the several uses of air pathway model results. With fugitive dust sources, which are most often ground level sources, the highest modeled concentrations will generally be found near the ground right on the property boundary. Receptors are then arrayed along the property boundary in order to determine if any ambient air quality standards are exceeded. Receptors are placed behind this line when it is necessary to determine concentrations to be used in a risk assessment or other population-based analysis.

Additional receptors may be added for subsequent trials near estimated maxima to determine the actual maximum value.

The receptors used in this study are shown in Figure 8. The point marked "NET" represents seven closely spaced points that were placed to determine the location of the highest concentration. These receptors are also shown in Figure 9.

7.1 RESIDENTIAL/WORKING POPULATION

7.1.1 Property Line

In order to identify the locations of maximum concentration estimates, receptors were placed every 200 meters along the property boundary. The first receptor is located along the southern boundary of the site near the intersection of South 56th Street and Proctor. As the perimeter of the site is not an even multiple of 200 meters, the last boundary receptor, #31, is located only 78 meters from the first receptor.

All the receptors are located in the approximate breathing zone at 2 meters above the ground, except for three receptors used in the FDM run, which were located at the same spot as receptors #1, #2, and #31 but only 1 meter above the ground. These receptors were used to determine the relative importance of receptor height when modeling these sources.

Receptor #30 was moved back from the property line, as seen in Figure 8, to provide a minimal distance between this receptor and a PAH gas source area which had the property line at that location as its own edge.

Subsequent to the first modeling run, a net of seven receptors also shown in Figure 8, was located north of receptor #31 near the intersection of Proctor Street and the property boundary to better estimate the maximum concentration at the property boundary.

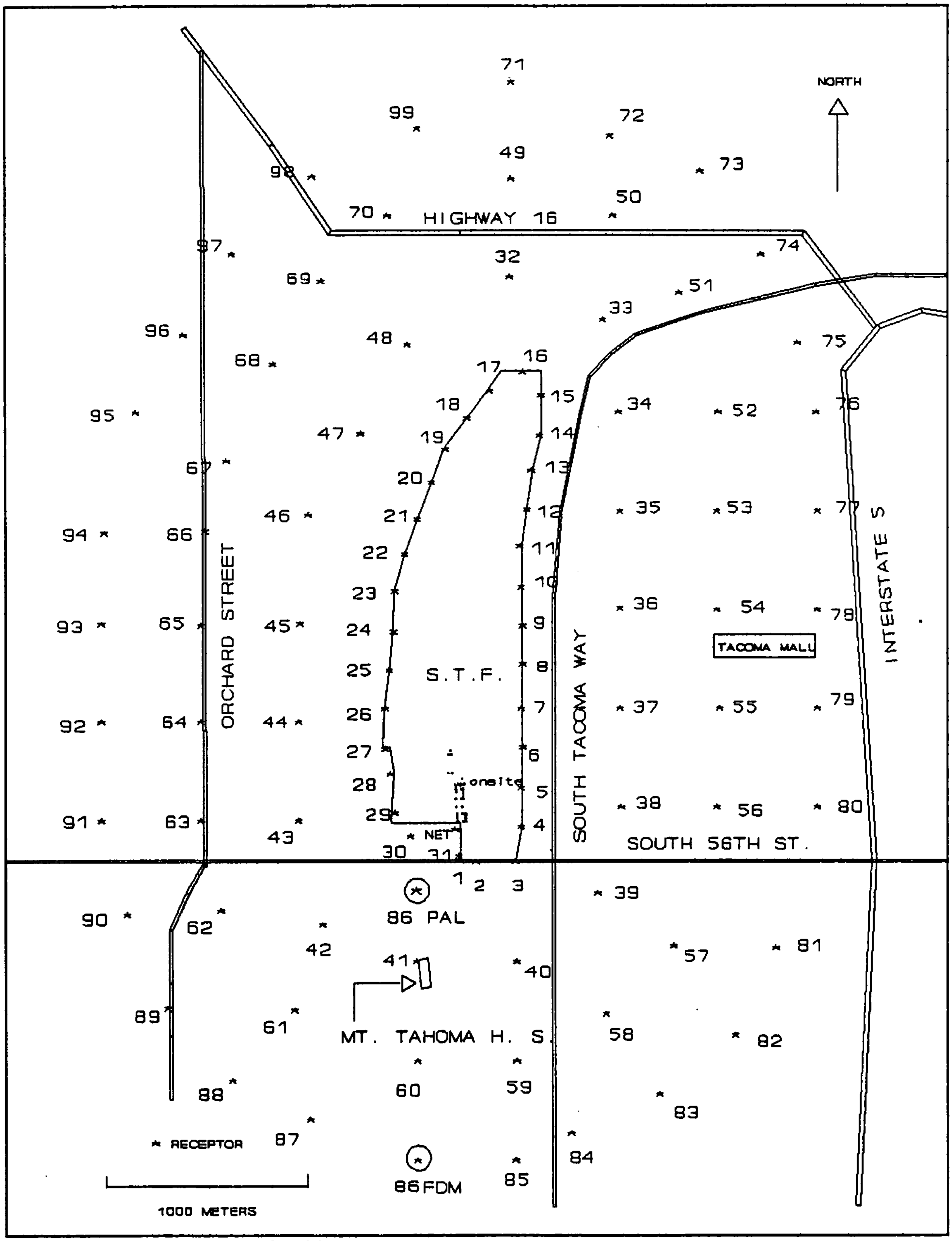

Figure 8 Locations of off-site receptors

7.1.2 Receptor Grid

Receptors were also placed on a rectangular grid with 500 meter spacing, reaching out approximately 1500 meters from the outer property boundary. The first receptor ring contains 17 receptor locations. Receptor #32 is located 500 meters to the north of the site and the receptors are numbered in clockwise order. All these receptors are 2 meters above ground.

The second receptor ring contains 22 receptor locations. Receptor #49 is located 1000 meters to the north of the site and the receptors are numbered in clockwise order. All the receptors are at 2 meters above ground.

The third receptor ring contains 29 receptor locations. Receptor #71 is located 1500 meters to the north of the site and the receptors are numbered in clockwise order. All the receptors are at 2 meters above ground.

The Point-Area-Line (PAL) model allows only 99 receptors. In order to better define the location of the off-site maximum, receptor #86 was moved to a location between the property boundary and the first ring in the PAL runs.

7.2 ON-SITE RECEPTORS

In order to identify the potential locations of maximum concentration estimates on the STF site, receptors were placed approximately 12 meters apart along the edge of the platted way (the functional equivalent of a right-of-way) of Proctor. Where modeled parking lots overlapped the edge of the platted way, the receptors were placed 8 meters from the edge of the parking lot. Additional receptors were placed at the north end of Proctor and adjacent to the travel routes of trucks beyond the north end of Proctor. The locations of these receptors are shown in Figure 9.

7.3 SPECIAL RECEPTORS

No special receptors for census tracts or population clusters were utilized for this preliminary modeling study.

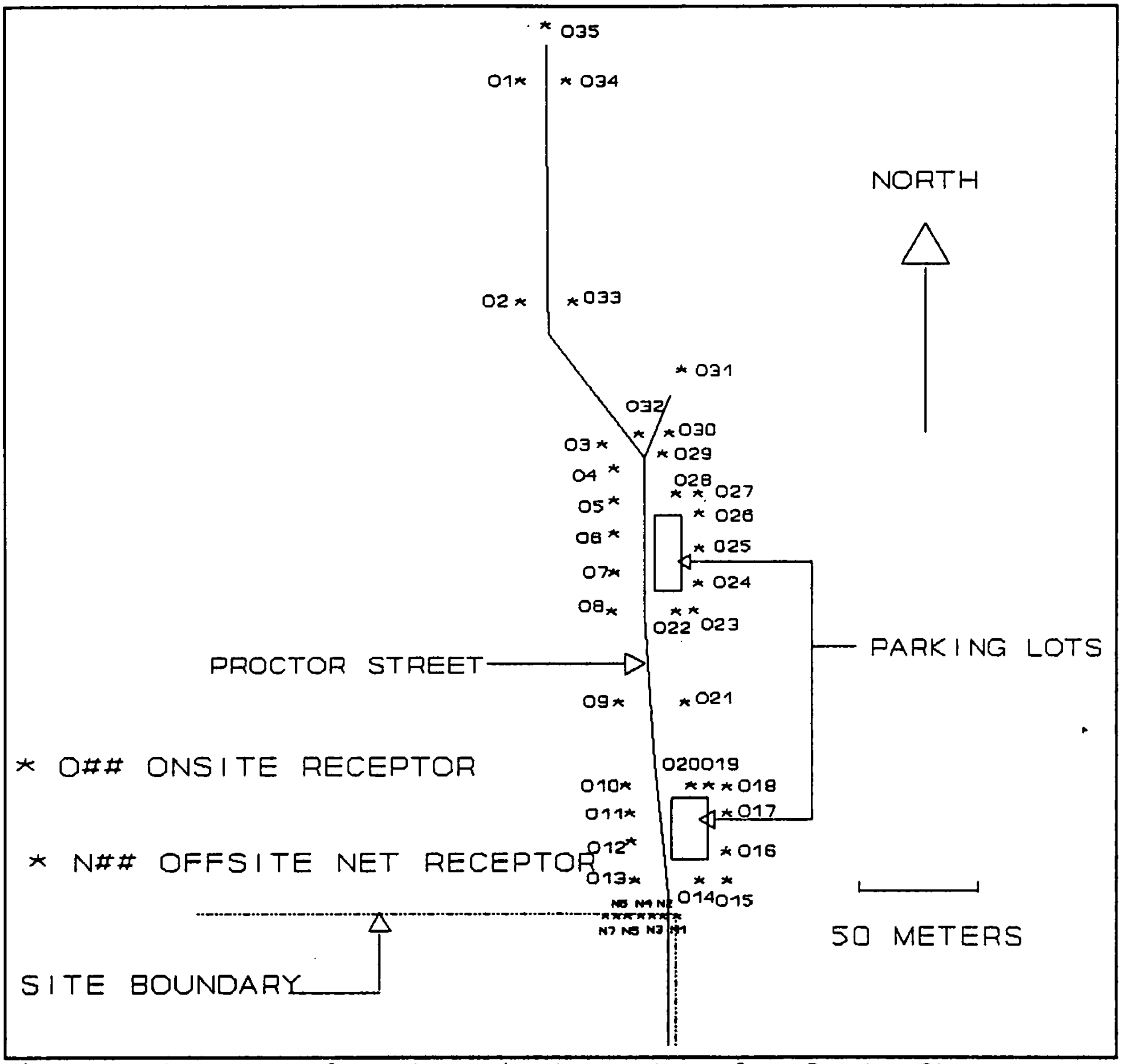

Figure 9. Locations of on-site and net receptors along Proctor Street.

8.0 ESTIMATED BACKGROUND CONCENTRATIONS

Ambient monitoring data were obtained from the WDOE Mt. Tahoma High School site and the PSAPCA South 32nd and South D Streets site to calculate the background concentrations of total suspended particulate matter in the vicinity of the site.

8.1 PARTICULATE MATTER

8.1.1 Total Suspended Particulate Matter

The total suspended particulate measurements were discontinued at the Mt. Tahoma site in March of 1988. Measurements continue at the South 32nd and South D Streets (Willard School) site, but are expected to be discontinued this year.

During the most recent year of available data, 1990, there were no exceedances of the state standard for total suspended particulate at the Willard School site. The annual geometric mean for 1990 was 33.1 $\mu g/m^3$. This site has shown a gradual and monotonic decrease in measured concentrations over a four year period from a 1987 annual geometric mean of 56 $\mu g/m^3$. During 1987 there were 3 days recorded above the state ambient air quality standard of 150 $\mu g/m^3$ while in 1990 there were none. The highest value recorded in 1990 was 133 $\mu g/m^3$ while the second highest value was 102 $\mu g/m^3$.

During its last full year in operation, 1987, the Mt. Tahoma site reported an annual geometric mean of 50 $\mu g/m^3$. In that year there were 3 values recorded above the state ambient air quality standards, on the same days similar high values were reported at the Willard School site. It is reasonable to assume that the data from this site would have followed a pattern similar to the decline in maximum measured concentration observed at the Willard School site.

It is important to note that these values are for TSP and not for PM-10. No general correlation is possible between TSP and PM-10 concentrations as this would be very specific to a local area. However the correlations that have been developed have a scaling factor that generally ranges from 0.6 to 0.8. We can make a conservative conversion by estimating the PM-10 ambient concentration to be 0.8 of the TSP concentration. The resulting value will be added to the calculated PM-10 concentrations, to obtain the total particulate matter concentrations at the site boundary.

Even though the Willard School site is now demonstrating attainment of the national ambient air quality standards, the Tacoma particulate matter non-attainment area still includes the STF site. In order to exclude this site it would be necessary for the WDOE to request a revision of the boundaries and submit the monitoring data.

8.1.2 Lead

No measurements of lead were made on the particulate samples collected at the WDOE or at the PSAPCA sites and no other lead measurements in the vicinity are known to exit.

8.2 POLYNUCLEAR AROMATIC HYDROCARBONS

No measurements of PAH were made on any of the particulate samples collected at either WDOE or PSAPCA sites and no other PAH measurements in the vicinity are known to exist.

9.0 AIR DISPERSION CALCULATIONS

9.1 RESULTS

The 24-hour ambient air quality standard for particulate matter is not to be exceeded more than once a year. Thus it is necessary to report both the highest and second high concentration at a receptor. The annual standard for particulate matter, the quarterly standard for lead, and the annual ASIL for PAH are not to be exceeded.

The high and second high 24-hour concentrations for particulate matter, the high quarterly concentrations for lead, and the high annual concentrations for particulate matter and PAH for each year at the boundary receptors, calculated by FDM, are given in Table 6 and the non-boundary receptors, calculated by PAL are given in Table 7. Based on these results, modeling was carried out in detail for 1981, the year with the highest reported concentrations. Additional modeling was carried out with a net of seven points closer to the point where Proctor Street enters the site and a net of 35 points along Proctor within the site. The maximum receptor for non-boundary receptors was a similarly placed receptor, nearer to the site than the other non-boundary receptors.

The preliminary modeling to establish the year for detailed modeling followed exploratory modeling which had shown the estimated concentrations from vehicle emissions to be much greater than the estimated concentrations from erosion emissions. Thus the comparison to establish the year for detailed modeling did not include erosion modeling for each year. The detailed modeling for 1981 confirmed the preliminary estimate that vehicle emissions were much more important than erosion emissions at the maximum concentration receptors.

9.1.1 Particulate Matter

The highest and second highest estimated concentrations of PM-10 and lead for the net of seven maximum off-site receptors and the net of on-site receptors are summarized in Tables 8 and 9. Because these receptors are within or on the property boundary, these results have all been calculated using FDM. High and second high concentrations are reported for all receptors for PM-10 and lead in the Appendix.

The highest second-high off-site 24-hour average PM-10 concentration is estimated at 16.7 $\mu g/m^3$ at the receptor nearest the point on Proctor Street where it enters the site (#N1). The highest annual off-site average PM-10 concentration is estimated to be 1.35 $\mu g/m^3$, at the next receptor to the west (#N2).

The highest second high on-site 24-hour average PM-10 concentration is estimated to be 40.8 $\mu g/m^3$ at the receptor south of the northern parking lot (#022). The highest annual on-site average PM-10 concentration is estimated at 2.0 $\mu g/m^3$, at a receptor north of the same parking lot (#029).

Table 6. Highest Concentrations for Boundary Receptors[1]

Averaging Period	Receptor	Highest Conc. due to Vehicles (g/m^3)	Specific Period	2nd Highest Conc. due to Vehicles (g/m^3)	Specific Period
PM-10					
24 hr.	31	1.4E-6	12-12-78	1.27E-6	05-05-78
24 hr.	31	2.2E-6	01-24-79	1.30E-6	12-29-79
24 hr.	31	1.5E-6	02-22-80	1.26E-6	01-28-80
24 hr.	31	2.2E-6	04-13-81	1.95E-6	02-28-81
24 hr.	31	1.5E-6	11-17-87	1.49E-6	05-23-87
Annual	31	7.10E-8	1978		
Annual	31	7.83E-8	1979		
Annual	02	8.22E-8	1980		
Annual	31	9.75E-8	1981		
Annual	31	7.33E-8	1987		
PAH					
Annual	31	1.64E-12	1978		
Annual	31	1.97E-12	1979		
Annual	31	1.94E-12	1980		
Annual	31	2.22E-12	1981		
Annual	31	1.81E-12	1987		

LEAD

		YEAR	Highest Concentration by Quarter 1st QTR	2nd QTR	3rd QTR	4th QTR
Qtr.	31[2]	1978	0.76E-8	0.75E-8(5)	1.11E-8(5)	0.99E-8
Qtr.	31	1979	0.83E-8	0.83E-8(5)	1.19E-8(5)	1.12E-8
Qtr.	31	1980	0.98E-8	0.92E-8	1.08E-8(5)	0.85E-8
Qtr.	31	1981	1.39E-8	0.63E-8	1.29E-8	1.02E-8
Qtr.	31	1987	0.77E-8	0.76E-8(5)	1.31E-8	0.85E-8

[1] These concentrations are based on vehicles sources only. The contributions from erosion and/or vapor are orders of magnitude less. This table reports only concentrations for receptors #1 through #31 modeled by FDM.

[2] The highest value occurred at receptor #31 except in the quarters marked with "(5)", when receptor #5 recorded the highest value.

Table 7: Highest Concentrations for Non-Boundary Receptors[1]

	Averaging Period	Receptor	Highest Conc. due to Vehicles (g/m^3)	Specific Period	2nd Highest Conc. due to Vehicles (g/m^3)	Specific Period
PM-10						
	24 hr.	86	2.2E-7	9-18-78	1.92E-7	10-19-78
	24 hr.	86	2.4E-7	3-12-79	1.93E-7	12-27-79
	24 hr.	86	2.2E-7	9-29-80	1.51E-7	7-28-80
	24 hr.	86	1.6E-7	10-12-81	1.54E-7	7-10-81
	24 hr.	86	1.6E-7	9-01-87	1.21E-7	3-25-87
	Annual	86	2.64E-8	1978		
	Annual	86	1.96E-8	1979		
	Annual	86	1.63E-8	1980		
	Annual	86	1.86E-8	1981		
	Annual	86	1.89E-8	1987		
PAH						
	Annual	86	9.3E-13	1978		
	Annual	86	6.9E-13	1979		
	Annual	86	5.8E-13	1980		
	Annual	86	6.4E-13	1981		
	Annual	86	6.7E-13	1987		

LEAD

		YEAR	Highest Concentration by Quarter 1st QTR	2nd QTR	3rd QTR	4th QTR
Qtr.	86	1978	3.13E-9	5.43E-9	5.26E-9	4.80E-9
Qtr.	86	1979	2.64E-9	3.88E-9	4.87E-9	2.60E-9
Qtr.	86	1980	2.31E-9	3.08E-9	4.94E-9	1.64E-9
Qtr.	86	1981	2.68E-9	3.41E-9	4.02E-9	2.71E-9
Qtr.	86	1987	2.83E-9	3.65E-9	4.17E-9	2.74E-9

[1] These concentration are based on vehicles sources only. The contributions from erosion and/or vapor are orders of magnitude less. This table reports only concentrations for receptors #32 through #99 modeled by PAL.

Table 8. Maximum PM-10 Concentrations - 1981 (g/m^3)

24-HOUR

	High			
	Total	Vehicle	Erosion	Day of Year
N1	2.04E-05	2.04E-05	6.79E-09	Apr. 13
N2	2.02E-05	2.02E-05	4.84E-09	Apr. 13
N3	1.13E-05	1.13E-05	2.30E-12	Oct. 18
020	3.04E-05	3.04E-05	1.72E-09	Feb. 3
022	4.78E-05	4.78E-05	0.00E 00	Mar. 13
028	3.66E-05	3.66E-05	9.44E-10	Feb 3

	Second High			
	Total	Vehicle	Erosion	Day of Year
N1	1.67E-05	1.67E-05	4.34E-10	Sept. 9
N2	1.46E-05	1.46E-05	6.62E-10	Dec. 12
N3	1.08E-05	1.08E-05	0.00E 00	Sept.25
020	2.85E-05	2.85E-05	5.19E-10	Oct. 13
022	4.08E-05	4.08E-05	0.00E 00	Sept.12
028	3.49E-05	3.49E-05	1.40E-12	Oct. 22

ANNUAL

	Total Combined	Vehicle Combined	Vehicle Line	Vehicle Area	Erosion
N1	1.25E-06	1.25E-06	7.72E-07	4.80E-07	4.66E-11
N2	1.35E-06	1.35E-06	9.06E-07	4.41E-07	5.42E-11
N3	8.05E-07	8.05E-07	4.21E-07	3.83E-07	6.14E-11
021	1.76E-06	1.76E-06	5.60E-07	1.20E-06	5.85E-16
029	2.00E-06	2.00E-06	5.19E-07	1.48E-06	3.42E-15
030	1.95E-06	1.95E-06	5.23E-07	1.43E-06	3.22E-15

Table 9. Maximum Concentrations for Lead, First Quarter, 1981[1] (g/m^3).

	Total Combined	Vehicle Combined	Vehicle Line	Vehicle Area	Erosion
N1	2.27E-07	2.27E-07	1.13E-07	1.14E-07	4.55E-11
N2	2.46E-07	2.46E-07	1.48E-07	9.81E-08	5.42E-11
N3	1.47E-07	1.47E-07	6.37E-08	8.31E-08	6.14E-11
022	3.41E-07	3.41E-07	6.20E-08	2.79E-07	6.26E-11
028	4.31E-07	4.31E-07	4.30E-08	3.88E-07	1.16E-10
029	3.42E-07	3.42E-07	6.10E-08	2.81E-07	1.15E-10

[1] Estimated using FDM.

The highest off-site lead quarterly average concentration is also at the second receptor (#N2) and is estimated to be 0.25 $\mu g/m^3$.

The highest on-site lead quarterly average concentration is at the next receptor to the east (#028), with a value of 0.43 $\mu g/m^3$.

9.1.2 Polynuclear Aromatic Hydrocarbons

The highest estimated concentrations of PAH for the net of seven maximum off-site receptors and the on-site receptors are summarized in Table 10. Because these receptors are within or on the property boundary, these results have all been calculated using FDM. High concentrations for PAH are reported for all receptors in the Appendix.

The highest annual average PAH concentration off-site is estimated at 45 picograms per cubic meter (pg/m^3) at the next receptor west from the point on the boundary where Proctor Street enters the site (#N2).

Table 10. Maximum Concentrations for PAH Annual - 1981[1] (g/m^3).

	Total Combined	Vehicle Combined	Vehicle Line	Vehicle Area	Erosion	Vapor
N1	4.13E-11	4.13E-11	2.02E-11	2.10E-11	1.12E-14	1.04E-14
N2	4.50E-11	4.50E-11	2.64E-11	1.86E-11	1.35E-14	1.18E-14
N3	2.77E-11	2.76E-11	1.21E-11	1.55E-11	1.56E-14	1.33E-14
028	9.59E-11	9.58E-11	1.04E-11	8.54E-11	6.58E-14	2.60E-14
029	8.22E-11	8.21E-11	1.45E-11	6.76E-11	7.28E-14	2.78E-14
030	7.30E-11	7.29E-11	1.49E-12	5.80E-12	6.79E-14	2.60E-14

[1] Estimated using FDM.

The highest estimated annual average concentration at an on-site receptor is 96 pg/m^3 at receptor #028.

9.2 COMPARISON WITH POTENTIAL ARAR

The second highest estimated daily PM-10 concentration at an off-site receptor (receptor #N1) of 16.7 $\mu g/m^3$ is the appropriate value to compare to the ambient air quality standard. It is about 11% of the PM-10 24-hour standard of 150 $\mu g/m^3$. However this concentration contributed by the site (almost entirely by vehicles on Proctor) must be added to the regional background for a proper comparison to the ambient air quality standard.

Although earlier data suggests the background concentrations at the STF site are lower than the concentrations measured at the Willard School site, the existing daily TSP background at the STF site can be conservatively estimated using the second highest concentration recorded at Willard School in 1990 (i.e., 102 $\mu g/m^3$). However, this is a TSP and not a PM-10 measurement. A conservative PM-10 estimate can be obtained by multiplying this value by 0.8, giving 82 $\mu g/m^3$. This result must then be added to the second high estimated concentration from receptor #N1, to obtain a total estimated second high concentration of 99 $\mu g/m^3$, which is still significantly short of the standard of 150 $\mu g/m^3$.

The highest estimated annual PM-10 concentration at an off-site receptor of 1.35 $\mu g/m^3$ is less than 3% of the PM-10 standard of 50 $\mu g/m^3$. Again take the concentration recorded at Willard School in 1990 (i.e., 33 $\mu g/m^3$) as the existing annual average TSP background at the site and multiply it by 0.8 to obtain a background PM-10 estimate of 26 $\mu g/m^3$. Now add it to the annual estimated concentration and the total is 28 $\mu g/m^3$, which is significantly less than the standard of 50 $\mu g/m^3$.

The highest estimated quarterly average for lead is 0.25 $\mu g/m^3$, which is again much less than the standard of 1.5 $\mu g/m^3$. No estimates of the background concentration of lead are available in the vicinity of the STF site.

The highest estimated concentration of PAH is more than an order of magnitude smaller than the corresponding ASIL. The estimate is 4.5×10^{-11} g/m^3 while the ASIL for this class is 6.0×10^{-10} g/m^3.

9.3 DISCUSSION

Three of the boundary receptors were set at a height of 1 meter while another receptor at the same location was at 2 meters high. Because the source height of the vehicles was set to 2 meters, the receptors at 2 meters high near the property boundary reported a concentration approximately twice that of the 1 meter high receptor. However at receptor 31, which is about 160 meters further from the property boundary, the 1 meter high receptor had the higher concentrations, 2.19 $\mu g/m^3$ compared to 2.16 $\mu g/m^3$ for the 24-hour averaging time. The differences on the annual average were proportionally the same.

In order to simplify the modeling activities the unpaved vehicle emissions sources were consolidated to two particle size classes. This was an insignificant adjustment. At receptor N1, for example, the difference in the concentration estimates for 2 or 3 particle size classes was less than 1% with the 3 class estimate being higher. At receptor 31 the difference was less than 2% with the 2 class estimate being higher.

The maximum value for PM-10 concentrations based only on erosion emissions occurs at Receptor 30. This value is 8.1×10^{-8} g/m^3. The maximum based only on vehicle emissions is 2.2×10^{-6} g/m^3, at Receptor 31. Even if we compare these maxima at different receptors (the difference would perhaps be greater at the same receptors) the erosion fugitive dust concentrations are seen to be about two orders of magnitude less than the vehicle fugitive dust concentrations.

The maximum concentrations modeled in this report are sufficiently below the national ambient air quality standards, even with background included, that any further air pathways dispersion modeling would be justified only if the concentrations measured in the Phase I soil investigation are more than an order of magnitude greater than the concentrations used here. No ambient monitoring is warranted at this time at any location near the STF site.

10.0 REFERENCES

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APPENDIX

This appendix contains summary tables for estimated concentrations for the PM-10, lead, and PAH generated by both FDM and PAL for 1981. The daily PM-10 estimates are for the highest and second highest day at each receptor. The lead estimates are for the highest quarter. Annual PM-10 and PAH results are also provided.

It is important to note that receptor #86 is in a different location for FDM and for PAL. For PAL, #86 is approximately 160 meters south of the site and for FDM #86 is approximately 1500 meters south of the site. Receptors #100, 101, and 102 are at the same locations as receptors 1, 2, and 31 respectively but are 1 meter, rather than 2 meters, above the surface.

Also included in the printed appendix is a directory of MS-DOS compatible diskettes containing the models (both source and executable), the meteorological data files (ASCII files), the post-processor programs (sample source code), all the input files (ASCII files), and all the output files (ASCII files). The diskettes are provided in a separate appendix.

Output of the PM10 daily files for 1981
Including FDM & PAL of:
vehicles combined
erosion
vehicles & erosion

Concentrations are in grams per cubic meter

Receptor	H1/H2	FDM Total conc.	FDM Vehicle conc.	FDM Erosion conc.	FDM Day	PAL Total conc.	PAL Vehicle conc.	PAL Erosion conc.	PAL Day
1	high1	1.990347E-06	1.988100E-06	2.246700E-09	103	1.390500E-06	1.390500E-06	0.000000E+00	277
1	high2	1.810625E-06	1.806400E-06	4.225000E-09	59	7.551000E-07	7.551000E-07	0.000000E+00	276
2	high1	1.411131E-06	1.411000E-06	1.308000E-10	255	5.212948E-07	5.211000E-07	1.948000E-10	256
2	high2	1.264170E-06	1.264000E-06	1.704000E-10	33	4.534059E-07	4.532500E-07	1.559000E-10	359
3	high1	4.280000E-07	4.280000E-07	3.000000E-13	13	1.644413E-07	1.644100E-07	3.134000E-11	57
3	high2	3.452430E-07	3.446000E-07	6.434000E-10	67	1.459600E-07	1.459600E-07	0.000000E+00	356
4	high1	3.977920E-07	3.967000E-07	1.091900E-09	350	1.073222E-07	1.073200E-07	2.181000E-12	12
4	high2	2.927000E-07	2.927000E-07	0.000000E+00	128	9.851011E-08	9.851000E-08	1.171000E-13	30
5	high1	5.654800E-07	5.653000E-07	1.797000E-10	226	1.645596E-07	1.637900E-07	7.696000E-10	65
5	high2	2.927000E-07	4.920000E-07	0.000000E+00	128	1.404423E-07	1.395100E-07	9.323000E-10	309
6	high1	6.036670E-07	6.029000E-07	7.672000E-10	206	8.871080E-08	8.860000E-08	1.108000E-10	58
6	high2	5.817270E-07	5.801000E-07	1.627000E-09	69	7.157004E-08	7.157000E-08	4.423000E-14	289
7	high1	4.269220E-07	4.265000E-07	4.222000E-10	60	9.532611E-08	9.429000E-08	1.036106E-09	115
7	high2	4.176750E-07	4.163000E-07	1.375500E-09	10	9.393152E-08	9.212999E-08	1.801530E-09	78
8	high1	4.255540E-07	4.248000E-07	7.538000E-10	285	6.868320E-08	6.808000E-08	6.032000E-10	41
8	high2	3.058000E-07	3.058000E-07	0.000000E+00	287	6.810716E-08	6.707000E-08	1.037167E-09	115
9	high1	2.912020E-07	2.909000E-07	3.022000E-10	251	5.844370E-08	5.338000E-08	5.063700E-09	308
9	high2	3.058000E-07	2.249000E-07	0.000000E+00	287	4.594915E-08	4.584000E-08	1.091509E-10	1
10	high1	2.343440E-07	2.317000E-07	2.644300E-09	295	4.113503E-08	4.102100E-08	1.140358E-10	1
10	high2	1.873360E-07	1.873000E-07	3.590000E-11	286	4.288940E-08	3.681300E-08	6.076400E-09	308
11	high1	1.710810E-07	1.671000E-07	3.980600E-09	295	3.516052E-08	3.505500E-08	1.055240E-10	1
11	high2	1.206610E-07	1.206000E-07	6.060000E-11	286	3.185377E-08	3.147900E-08	3.747670E-10	322
12	high1	1.262250E-07	1.229000E-07	3.324800E-09	295	3.077507E-08	3.068100E-08	9.407000E-11	1
12	high2	7.991700E-08	7.930000E-08	6.171000E-10	60	2.741936E-08	2.734700E-08	7.236000E-11	290
13	high1	9.714100E-08	9.450000E-08	2.641100E-09	295	2.720918E-08	2.712500E-08	8.417600E-11	1
13	high2	6.616900E-08	6.570000E-08	4.685000E-10	60	2.465868E-08	2.459300E-08	6.568000E-11	290
14	high1	8.259900E-08	8.040000E-08	2.199500E-09	295	2.484582E-08	2.476900E-08	7.682200E-11	1
14	high2	5.428600E-08	5.390000E-08	3.864000E-10	60	2.221359E-08	2.215400E-08	5.959000E-11	290
15	high1	5.783200E-08	5.620000E-08	1.632300E-09	295	2.169486E-08	2.162600E-08	6.886300E-11	1
15	high2	5.380100E-08	5.350000E-08	3.011000E-10	60	2.076525E-08	2.070900E-08	5.625000E-11	290
16	high1	5.592500E-08	5.550000E-08	4.247000E-10	60	2.019640E-08	2.013900E-08	5.740000E-11	290
16	high2	5.311600E-08	5.310000E-08	1.560000E-11	328	1.715558E-08	1.709800E-08	5.758300E-11	1
17	high1	8.571700E-08	8.569999E-08	1.650000E-11	297	1.893049E-08	1.887300E-08	5.749000E-11	290
17	high2	8.200900E-08	8.200000E-08	8.700000E-12	38	1.608100E-08	1.608100E-08	0.000000E+00	18
18	high1	8.695400E-08	8.690000E-08	5.370000E-11	233	1.775679E-08	1.770400E-08	5.279000E-11	103
18	high2	8.052100E-08	8.040000E-08	1.213000E-10	135	1.766570E-08	1.755700E-08	1.087000E-10	59
19	high1	9.207700E-08	9.200000E-08	7.660000E-11	37	2.470883E-08	2.463300E-08	7.583000E-11	103
19	high2	8.940000E-08	8.940000E-08	0.000000E+00	274	2.134606E-08	2.125000E-08	9.605999E-11	33

		FDM				PAL			
Receptor	H1/H2	Total conc.	Vehicle conc.	Erosion conc.	Day	Total conc.	Vehicle conc.	Erosion conc.	Day
20	high1	9.613201E-08	9.590000E-08	2.318000E-10	363	3.181893E-08	3.171900E-08	9.993000E-11	103
20	high2	8.940000E-08	9.330000E-08	0.000000E+00	274	2.363905E-08	2.350800E-08	1.310500E-10	33
21	high1	1.219370E-07	1.219000E-07	3.720000E-11	286	3.713320E-08	3.700500E-08	1.282000E-10	103
21	high2	1.082000E-07	1.082000E-07	0.000000E+00	262	3.202130E-08	3.182000E-08	2.013000E-10	36
22	high1	1.949270E-07	1.948000E-07	1.270000E-10	256	3.500350E-08	3.472600E-08	2.775000E-10	36
22	high2	1.785380E-07	1.772000E-07	1.338100E-09	304	3.451350E-08	3.435100E-08	1.625000E-10	255
23	high1	1.831990E-07	1.825000E-07	6.994000E-10	34	6.170555E-08	6.127000E-08	4.355500E-10	235
23	high2	1.717780E-07	1.716000E-07	1.779000E-10	256	3.148403E-08	3.141900E-08	6.503000E-11	329
24	high1	2.705330E-07	2.703000E-07	2.329000E-10	256	7.907250E-08	7.811000E-08	9.625000E-10	235
24	high2	2.073000E-07	2.073000E-07	0.000000E+00	355	5.179140E-08	5.147000E-08	3.214000E-10	234
25	high1	1.979170E-07	1.978000E-07	1.170000E-10	68	4.960850E-08	4.912000E-08	4.885000E-10	234
25	high2	1.970480E-07	1.965000E-07	5.481000E-10	207	4.736812E-08	4.736000E-08	8.122000E-12	288
26	high1	4.135550E-07	4.130000E-07	5.546000E-10	60	5.080000E-08	5.080000E-08	0.000000E+00	362
26	high2	2.540850E-07	2.539000E-07	1.850000E-10	143	4.925608E-08	4.925600E-08	7.882000E-14	13
27	high1	3.696870E-07	3.696000E-07	8.680000E-11	57	7.550190E-08	7.520000E-08	3.019000E-10	224
27	high2	3.201000E-07	3.201000E-07	0.000000E+00	356	6.413013E-08	6.413000E-08	1.319000E-13	13
28	high1	3.176160E-07	3.176000E-07	1.550000E-11	12	9.157034E-08	9.157000E-08	3.388000E-13	13
28	high2	3.201000E-07	2.957000E-07	0.000000E+00	356	7.910000E-08	7.910000E-08	0.000000E+00	158
29	high1	5.543000E-07	5.543000E-07	1.550000E-17	19	2.025432E-07	2.023800E-07	1.632000E-10	226
29	high2	3.201000E-07	3.673000E-07	0.000000E+00	356	1.913578E-07	1.906600E-07	6.978000E-10	225
30	high1	4.397830E-07	4.395000E-07	2.834000E-10	311	2.578797E-07	2.578100E-07	6.975000E-11	226
30	high2	3.855180E-07	3.854000E-07	1.182000E-10	292	2.307727E-07	2.302600E-07	5.127000E-10	225
31	high1	2.164746E-06	2.162800E-06	1.946300E-09	103	1.512200E-06	1.512200E-06	6.975000E-11	277
31	high2	1.951446E-06	1.947200E-06	4.245800E-09	59	8.226000E-07	8.226000E-07	5.127000E-10	276
32	high1	5.630900E-08	5.630000E-08	9.100000E-12	297	1.610542E-08	1.605800E-08	4.742000E-11	290
32	high2	5.500400E-08	5.500000E-08	4.500000E-12	38	1.142900E-08	1.142900E-08	0.000000E+00	18
33	high1	6.073900E-08	5.980000E-08	9.387000E-10	295	1.997869E-08	1.992200E-08	5.668990E-11	1
33	high2	5.212800E-08	5.200000E-08	1.276000E-10	251	1.456844E-08	1.453000E-08	3.844000E-11	290
34	high1	7.380000E-08	7.380000E-08	0.000000E+00	191	1.844207E-08	1.839600E-08	4.606710E-11	1
34	high2	5.217700E-08	5.390000E-08	4.980000E-11	251	1.630992E-08	1.630900E-08	9.237000E-13	291
35	high1	1.203180E-07	1.202000E-07	1.180000E-10	285	1.939402E-08	1.939300E-08	1.016000E-12	291
35	high2	9.099000E-08	9.090000E-08	8.960000E-11	68	1.798457E-08	1.774500E-08	2.395710E-10	115
36	high1	1.021000E-07	1.021000E-07	0.000000E+00	66	2.285442E-08	2.242600E-08	4.284160E-10	108
36	high2	8.311600E-08	8.240000E-08	7.157000E-10	209	2.093361E-08	2.088100E-08	5.261000E-11	58
37	high1	1.124280E-07	1.124000E-07	2.780000E-11	226	2.224370E-08	2.207100E-08	1.727000E-10	309
37	high2	8.318600E-08	1.103000E-07	7.010000E-11	209	2.120266E-08	2.119700E-08	5.659000E-12	292
38	high1	1.487000E-07	1.487000E-07	0.000000E+00	327	6.971231E-08	6.971000E-08	2.315000E-12	30
38	high2	8.318600E-08	1.338000E-07	0.000000E+00	209	3.662961E-08	3.650900E-08	1.206100E-10	33
39	high1	9.326499E-08	9.310000E-08	1.647000E-10	85	2.689343E-08	2.688800E-08	5.427000E-12	57
39	high2	7.310000E-08	7.310000E-08	0.000000E+00	56	2.660100E-08	2.660100E-08	3.323000E-15	3
40	high1	1.949660E-07	1.949000E-07	6.590000E-11	311	7.361273E-08	7.357000E-08	4.273000E-11	256
40	high2	1.764660E-07	1.761000E-07	3.665000E-10	207	5.982456E-08	5.979000E-08	3.456000E-11	359
41	high1	2.452410E-07	2.429000E-07	2.340700E-09	322	6.901318E-08	6.756000E-08	1.453176E-09	295
41	high2	2.058770E-07	2.015000E-07	4.377400E-09	308	6.618529E-08	6.612000E-08	6.529000E-11	251

Receptor	H1/H2	FDM Total conc.	Vehicle conc.	Erosion conc.	Day	PAL Total conc.	Vehicle conc.	Erosion conc.	Day
42	high1	1.238490E-07	1.238000E-07	4.930000E-11	311	3.876136E-08	3.869900E-08	6.236000E-11	69
42	high2	8.971899E-08	8.930000E-08	4.187000E-10	219	3.395764E-08	3.392300E-08	3.464000E-11	185
43	high1	1.221870E-07	1.216000E-07	5.872000E-10	58	4.481087E-08	4.473300E-08	7.787000E-11	185
43	high2	1.225080E-07	1.215000E-07	1.008000E-09	309	3.979999E-08	3.977600E-08	2.399000E-11	226
44	high1	1.083550E-07	1.073000E-07	1.054600E-09	260	2.424005E-08	2.424000E-08	4.922000E-14	13
44	high2	1.225170E-07	9.450000E-08	9.400000E-12	309	2.292100E-08	2.292100E-08	0.000000E+00	29
45	high1	1.751120E-07	1.736000E-07	1.512000E-09	60	1.918904E-08	1.918900E-08	3.762000E-14	13
45	high2	9.660000E-08	9.660000E-08	0.000000E+00	343	1.652788E-08	1.650000E-08	2.788000E-11	225
46	high1	5.520000E-08	5.520000E-08	0.000000E+00	54	1.545810E-08	1.533600E-08	1.221000E-10	234
46	high2	5.427900E-08	5.380000E-08	4.789000E-10	136	1.452823E-08	1.452600E-08	2.230000E-12	288
47	high1	9.300000E-08	9.300000E-08	0.000000E+00	323	2.208524E-08	2.192700E-08	1.582400E-10	235
47	high2	5.432500E-08	7.329999E-08	4.590000E-11	136	1.454209E-08	1.447000E-08	7.209000E-11	255
48	high1	4.841500E-08	4.840000E-08	1.490000E-11	286	1.818038E-08	1.812100E-08	5.938000E-11	103
48	high2	4.800000E-08	4.800000E-08	0.000000E+00	262	1.471559E-08	1.462400E-08	9.159001E-11	36
49	high1	4.550900E-08	4.550000E-08	8.500000E-12	297	1.335530E-08	1.331600E-08	3.930000E-11	290
49	high2	4.460500E-08	4.460000E-08	4.600000E-12	38	8.623999E-09	8.623999E-09	0.000000E+00	18
50	high1	4.873100E-08	4.770000E-08	1.031100E-09	295	1.707630E-08	1.702600E-08	5.029800E-11	1
50	high2	3.961600E-08	3.960000E-08	1.590000E-11	286	1.294251E-08	1.290800E-08	3.451000E-11	290
51	high1	4.649700E-08	4.640000E-08	9.669999E-11	285	1.301894E-08	1.298600E-08	3.294390E-11	1
51	high2	4.150000E-08	4.150000E-08	0.000000E+00	191	1.264470E-08	1.264400E-08	7.016000E-13	291
52	high1	5.210100E-08	5.180000E-08	3.005000E-10	60	1.212064E-08	1.212000E-08	6.417000E-13	291
52	high2	4.804200E-08	4.790000E-08	1.425000E-10	33	1.074084E-08	1.071500E-08	2.584000E-11	290
53	high1	4.205300E-08	4.180000E-08	2.531000E-10	214	1.231466E-08	1.231400E-08	6.554000E-13	291
53	high2	4.804300E-08	3.950000E-08	3.000000E-13	33	1.095856E-08	1.076000E-08	1.985650E-10	108
54	high1	7.526200E-08	7.510000E-08	1.616000E-10	69	1.041550E-08	1.041500E-08	5.045000E-13	291
54	high2	4.804400E-08	6.250000E-08	1.200000E-12	33	8.991001E-09	8.991000E-09	1.231000E-15	3
55	high1	7.956501E-08	7.940000E-08	1.652000E-10	223	1.220600E-08	1.220600E-08	0.000000E+00	66
55	high2	5.936700E-08	5.930000E-08	6.680000E-11	189	1.138741E-08	1.136400E-08	2.341000E-11	58
56	high1	1.008000E-07	1.008000E-07	0.000000E+00	327	3.724120E-08	3.724000E-08	1.202000E-12	30
56	high2	5.938100E-08	6.740000E-08	1.460000E-11	189	1.983843E-08	1.976900E-08	6.943000E-11	33
57	high1	4.796600E-08	4.790000E-08	6.640000E-11	85	1.774000E-08	1.774000E-08	2.239000E-15	3
57	high2	4.589300E-08	4.580000E-08	9.310000E-11	246	1.723903E-08	1.723900E-08	2.975000E-14	4
58	high1	5.640800E-08	5.640000E-08	7.899999E-12	310	2.197268E-08	2.196400E-08	8.679999E-12	311
58	high2	5.490000E-08	5.490000E-08	0.000000E+00	362	1.949977E-08	1.946100E-08	3.877000E-11	267
59	high1	1.974910E-07	1.970000E-07	4.910000E-10	255	3.879617E-08	3.876500E-08	3.117000E-11	256
59	high2	1.242050E-07	1.241000E-07	1.055000E-10	354	3.641900E-08	3.641900E-08	0.000000E+00	303
60	high1	8.568000E-08	8.520000E-08	4.804000E-10	218	3.279800E-08	3.279800E-08	0.000000E+00	29
60	high2	7.920000E-08	7.920000E-08	0.000000E+00	19	3.105007E-08	3.102000E-08	3.007000E-11	359
61	high1	6.690400E-08	6.580000E-08	1.104000E-09	108	2.308600E-08	2.308600E-08	0.000000E+00	66
61	high2	5.704100E-08	5.630000E-08	7.415000E-10	115	2.299889E-08	2.260000E-08	3.988900E-10	209
62	high1	6.931401E-08	6.910000E-08	2.144000E-10	58	2.046814E-08	2.042300E-08	4.514000E-11	189
62	high2	5.590000E-08	5.590000E-08	0.000000E+00	66	1.881033E-08	1.880200E-08	8.331000E-12	226
63	high1	7.721300E-08	7.700000E-08	2.130000E-10	229	1.795381E-08	1.792500E-08	2.881000E-11	185
63	high2	4.774100E-08	4.730000E-08	4.415000E-10	76	1.677800E-08	1.677800E-08	0.000000E+00	327

Receptor	H1/H2	FDM Total conc.	Vehicle conc.	Erosion conc.	Day	PAL Total conc.	Vehicle conc.	Erosion conc.	Day
64	high1	4.050100E-08	4.050000E-08	1.200000E-12	12	1.066300E-08	1.066300E-08	0.000000E+00	158
64	high2	4.774300E-08	4.040000E-08	1.200000E-12	76	1.034402E-08	1.034400E-08	1.913000E-14	13
65	high1	4.221100E-08	4.220000E-08	1.100000E-11	57	8.231000E-09	8.231000E-09	0.000000E+00	29
65	high2	4.167400E-08	4.150000E-08	1.737000E-10	257	7.830049E-09	7.812000E-09	1.805000E-11	224
66	high1	7.869500E-08	7.800000E-08	6.951000E-10	60	1.025502E-08	1.025500E-08	2.015000E-14	13
66	high2	5.950000E-08	5.950000E-08	0.000000E+00	343	1.008507E-08	1.006600E-08	1.907000E-11	225
67	high1	4.081900E-08	4.080000E-08	1.940000E-11	284	6.891000E-09	6.891000E-09	2.015000E-14	18
67	high2	3.519700E-08	3.500000E-08	1.969000E-10	176	6.669000E-09	6.669000E-09	1.907000E-11	362
68	high1	4.760000E-08	4.760000E-08	0.000000E+00	355	1.556317E-08	1.535900E-08	2.041700E-10	235
68	high2	3.519700E-08	4.640000E-08	3.000000E-13	176	1.180386E-08	1.172700E-08	7.686000E-11	234
69	high1	5.560000E-08	5.560000E-08	0.000000E+00	323	1.227662E-08	1.218300E-08	9.362000E-11	235
69	high2	3.529300E-08	4.390000E-08	9.600001E-11	176	8.873930E-09	8.832000E-09	4.193000E-11	255
70	high1	3.331100E-08	3.330000E-08	1.100000E-11	286	1.251869E-08	1.247800E-08	4.069000E-11	103
70	high2	3.290000E-08	3.290000E-08	0.000000E+00	262	1.030798E-08	1.024200E-08	6.598000E-11	36
71	high1	3.570700E-08	3.570000E-08	7.400000E-12	297	1.131876E-08	1.128500E-08	3.376000E-11	290
71	high2	3.440400E-08	3.440000E-08	4.000000E-12	38	6.801000E-09	6.801000E-09	0.000000E+00	18
72	high1	3.320400E-08	3.240000E-08	8.043000E-10	295	1.478574E-08	1.474100E-08	4.474300E-11	1
72	high2	2.141200E-08	2.140000E-08	1.180000E-11	286	1.237328E-08	1.234000E-08	3.328000E-11	290
73	high1	3.730000E-08	3.730000E-08	0.000000E+00	191	1.303404E-08	1.299900E-08	3.504080E-11	1
73	high2	2.141200E-08	3.040000E-08	6.000000E-13	286	1.026858E-08	1.026800E-08	5.809000E-13	291
74	high1	4.215300E-08	4.210000E-08	5.320000E-11	285	1.035055E-08	1.035000E-08	5.488000E-13	291
74	high2	3.413700E-08	3.410000E-08	3.750000E-11	68	9.105370E-09	9.082000E-09	2.337000E-11	290
75	high1	3.350000E-08	3.350000E-08	0.000000E+00	66	9.164492E-09	9.163999E-09	4.925000E-13	291
75	high2	3.162600E-08	3.150000E-08	1.261000E-10	10	7.795721E-09	7.777000E-09	1.872000E-11	290
76	high1	2.604700E-08	2.590000E-08	1.471000E-10	214	8.895481E-09	8.895000E-09	4.807000E-13	291
76	high2	3.164400E-08	2.460000E-08	1.760000E-11	10	7.428036E-09	7.428000E-09	3.552000E-14	2
77	high1	4.127900E-08	4.120000E-08	7.920000E-11	69	8.364437E-09	8.364000E-09	4.371000E-13	291
77	high2	3.183500E-08	3.570000E-08	1.909000E-10	10	6.365007E-09	6.365000E-09	6.505000E-15	289
78	high1	2.860000E-08	2.860000E-08	0.000000E+00	15	8.012001E-09	8.012000E-09	9.665000E-16	3
78	high2	2.722600E-08	2.720000E-08	2.560000E-11	197	7.254000E-09	7.254000E-09	0.000000E+00	66
79	high1	5.708900E-08	5.700000E-08	8.850000E-11	225	8.906210E-09	8.864000E-09	4.221000E-11	65
79	high2	4.350000E-08	4.350000E-08	0.000000E+00	243	8.082000E-09	8.082000E-09	0.000000E+00	19
80	high1	6.740000E-08	6.740000E-08	8.850000E-17	327	2.438078E-08	2.438000E-08	7.814000E-13	30
80	high2	4.350000E-08	3.940000E-08	0.000000E+00	243	1.285620E-08	1.280700E-08	4.919600E-11	33
81	high1	3.493400E-08	3.460000E-08	3.343000E-10	175	1.092600E-08	1.092600E-08	1.367000E-15	3
81	high2	3.296900E-08	3.260000E-08	3.688000E-10	41	9.242000E-09	9.242000E-09	0.000000E+00	357
82	high1	3.915900E-08	3.900000E-08	1.588000E-10	257	1.370900E-08	1.370900E-08	0.000000E+00	356
82	high2	3.313900E-08	3.310000E-08	3.900000E-11	142	1.270052E-08	1.269800E-08	2.518000E-12	57
83	high1	3.560500E-08	3.560000E-08	4.900000E-12	310	1.298518E-08	1.298000E-08	5.183000E-12	311
83	high2	3.130000E-08	3.130000E-08	0.000000E+00	362	1.176400E-08	1.176400E-08	0.000000E+00	266
84	high1	5.186500E-08	5.170000E-08	1.651000E-10	148	2.383407E-08	2.381700E-08	1.707000E-11	256
84	high2	5.162200E-08	5.160000E-08	2.240000E-11	311	2.047989E-08	2.046500E-08	1.489000E-11	359
85	high1	9.536100E-08	9.490000E-08	4.615000E-10	255	2.158300E-08	2.158300E-08	1.707000E-11	303
85	high2	9.272400E-08	9.260000E-08	1.244000E-10	103	2.116500E-08	2.116500E-08	1.489000E-11	277

Receptor	H1/H2	FDM Total conc.	Vehicle conc.	Erosion conc.	Day	PAL Total conc.	Vehicle conc.	Erosion conc.	Day
86[1]	high1	6.909700E-08	6.870000E-08	3.970000E-10	59	1.585102E-07	1.583800E-07	1.302000E-10	285
86	high2	6.570000E-08	6.570000E-08	0.000000E+00	19	1.537600E-07	1.537600E-07	0.000000E+00	191
87	high1	6.510400E-08	6.420000E-08	9.043000E-10	115	2.242894E-08	2.239500E-08	3.394000E-11	285
87	high2	5.160500E-08	5.120000E-08	4.049000E-10	346	2.172200E-08	2.172200E-08	0.000000E+00	191
88	high1	4.120000E-08	4.120000E-08	0.000000E+00	15	1.414700E-08	1.414700E-08	0.000000E+00	66
88	high2	4.138800E-08	4.050000E-08	8.881000E-10	108	1.384300E-08	1.374300E-08	1.000000E-10	214
89	high1	3.188000E-08	3.160000E-08	2.805000E-10	249	1.483320E-08	1.479800E-08	3.520000E-11	69
89	high2	2.996500E-08	2.990000E-08	6.470000E-11	245	1.358086E-08	1.357500E-08	5.858000E-12	226
90	high1	2.734700E-08	2.720000E-08	1.475000E-10	91	1.492843E-08	1.489200E-08	3.643400E-11	223
90	high2	2.996500E-08	2.710000E-08	0.000000E+00	245	1.428287E-08	1.425400E-08	2.887000E-11	225
91	high1	5.829200E-08	5.810000E-08	1.919000E-10	229	1.152800E-08	1.152800E-08	0.000000E+00	327
91	high2	3.322100E-08	3.280000E-08	4.208000E-10	76	9.472787E-09	9.470000E-09	2.787000E-12	203
92	high1	2.781100E-08	2.680000E-08	1.011200E-09	294	6.510000E-09	6.510000E-09	0.000000E+00	158
92	high2	2.587100E-08	2.580000E-08	7.110000E-11	248	5.125710E-09	5.099000E-09	2.671000E-11	176
93	high1	4.555600E-08	4.530000E-08	2.564000E-10	260	6.717000E-09	6.717000E-09	0.000000E+00	29
93	high2	2.587100E-08	3.420000E-08	2.000000E-13	248	6.403012E-09	6.403000E-09	1.190000E-14	13
94	high1	3.725800E-08	3.720000E-08	5.830000E-11	305	7.689420E-09	7.672000E-09	1.742000E-11	224
94	high2	3.340100E-08	3.340000E-08	9.000000E-13	12	5.066520E-09	5.055000E-09	1.152000E-11	225
95	high1	5.091400E-08	5.060000E-08	3.143000E-10	60	6.911013E-09	6.911000E-09	1.222000E-14	13
95	high2	3.614500E-08	3.610000E-08	4.540000E-11	143	5.760780E-09	5.730000E-09	3.078000E-11	253
96	high1	2.971100E-08	2.970000E-08	1.100000E-11	311	6.085988E-09	6.085000E-09	9.883000E-13	288
96	high2	2.793600E-08	2.790000E-08	3.600000E-11	68	5.020660E-09	5.004000E-09	1.666000E-11	254
97	high1	3.613300E-08	3.610000E-08	3.320000E-11	256	1.206497E-08	1.191600E-08	1.489700E-10	235
97	high2	3.410000E-08	3.410000E-08	0.000000E+00	355	8.469220E-09	8.415000E-09	5.422000E-11	234
98	high1	4.143300E-08	4.140000E-08	3.300000E-11	256	7.874601E-09	7.839001E-09	3.560000E-11	255
98	high2	4.080000E-08	4.080000E-08	0.000000E+00	323	7.240980E-09	7.186000E-09	5.498000E-11	36
99	high1	2.857600E-08	2.830000E-08	2.761000E-10	217	1.389100E-05[2]	1.389100E-05		277
99	high2	2.817700E-08	2.810000E-08	7.730000E-11	363	8.076000E-06	8.076000E-06		276
100[3]	high1	2.007247E-06	2.005000E-06	2.246700E-09	103				
100	high2	1.826725E-06	1.822500E-06	4.225000E-09	59				
101	high1	1.413331E-06	1.413200E-06	1.308000E-10	255				
101	high2	1.267668E-06	1.267500E-06	1.680000E-10	33				
102	high1	2.186246E-06	2.184300E-06	1.946300E-09	103				
102	high2	1.970846E-06	1.966600E-06	4.245800E-09	59				
N1	high1	2.043739E-05	2.043060E-05	6.789100E-09	103				
N1	high2	1.673023E-05	1.672980E-05	4.341000E-10	255				
N2	high1	2.019324E-05	2.018840E-05	4.836200E-09	103				
N2	high2	1.463476E-05	1.463410E-05	6.619000E-10	346				

[1] Receptor 86 is in different location for FDM and PAL.
[2] These points change from Point 99 to Net Point 1. Erosion was not done for Net Point 1.
[3] Points 100,101,102 are the same location as 1,2,31 but the receptor is at a height of 1 meter rather than 2 meters.

Receptor	H1/H2	FDM Total conc.	Vehicle conc.	Erosion conc.	Day	PAL Total conc.	Vehicle conc.	Erosion conc.	Day
N3	high1	1.125651E-05	1.125650E-05	7.300000E-12	291				
N3	high2	1.075000E-05	1.075000E-05	0.000000E+00	268				
N4	high1	8.831811E-06	8.831800E-06	1.060000E-11	291				
N4	high2	7.325997E-06	7.321700E-06	4.296500E-09	58				
N5	high1	7.131716E-06	7.131700E-06	1.640000E-11	291				
N5	high2	6.394410E-06	6.390800E-06	3.610400E-09	58				
N6	high1	5.922225E-06	5.922200E-06	2.450000E-11	291				
N6	high2	5.288065E-06	5.283900E-06	4.165500E-09	58				
N7	high1	5.020834E-06	5.020800E-06	3.390000E-11	291				
N7	high2	4.730210E-06	4.724700E-06	5.510000E-09	58				
O1	high1	3.181121E-06	3.181000E-06	1.215000E-10	256				
O1	high2	2.553400E-06	2.553400E-06	0.000000E+00	323				
O2	high1	2.568948E-06	2.568600E-06	3.479000E-10	256				
O2	high2	2.527600E-06	2.527600E-06	0.000000E+00	356				
O3	high1	7.124487E-06	7.121500E-06	2.987400E-09	256				
O3	high2	6.831200E-06	6.831200E-06	0.000000E+00	356				
O4	high1	1.050040E-05	1.050040E-05	0.000000E+00	356				
O4	high2	8.416569E-06	8.414700E-06	1.869700E-09	311				
O5	high1	1.176180E-05	1.176180E-05	0.000000E+00	356				
O5	high2	1.024449E-05	1.024390E-05	5.947000E-10	267				
O6	high1	1.298473E-05	1.298460E-05	1.251000E-10	12				
O6	high2	9.658812E-06	9.658100E-06	7.118000E-10	37				
O7	high1	1.249090E-05	1.249090E-05	0.000000E+00	58				
O7	high2	1.169660E-05	1.169660E-05	0.000000E+00	309				
O8	high1	1.091680E-05	1.091680E-05	0.000000E+00	58				
O8	high2	9.831900E-06	9.831900E-06	0.000000E+00	291				
O9	high1	9.073736E-06	9.073700E-06	3.590000E-11	308				
O9	high2	8.745200E-06	8.745200E-06	0.000000E+00	268				
O10	high1	8.218102E-06	8.218100E-06	3.000000E-12	12				
O10	high2	7.719113E-06	7.717300E-06	1.813400E-09	267				
O11	high1	7.738100E-06	7.738100E-06	0.000000E+00	19				
O11	high2	7.683204E-06	7.683200E-06	3.500000E-12	11				
O12	high1	9.962776E-06	9.955000E-06	7.776100E-09	58				
O12	high2	8.762209E-06	8.759700E-06	2.509000E-09	309				
O13	high1	9.710223E-06	9.704199E-06	6.023900E-09	58				
O13	high2	8.947511E-06	8.947501E-06	1.000000E-11	291				
O14	high1	2.708059E-05	2.707820E-05	2.387400E-09	103				
O14	high2	2.260805E-05	2.260550E-05	2.547300E-09	36				
O15	high1	9.021202E-06	9.021200E-06	1.400000E-12	13				
O15	high2	8.282928E-06	8.282400E-06	5.288000E-10	233				
O16	high1	1.004824E-05	1.004820E-05	4.080000E-11	225				
O16	high2	9.820285E-06	9.819701E-06	5.850000E-10	224				
O17	high1	1.710273E-05	1.710150E-05	1.229000E-09	225				
O17	high2	1.536411E-05	1.536410E-05	1.330000E-11	226				

Receptor	H1/H2	FDM Total conc.	Vehicle conc.	Erosion conc.	Day	PAL Total conc.	Vehicle conc.	Erosion conc.	Day
018	high1	1.306200E-05	1.306200E-05	4.100000E-12	10				
018	high2	1.159496E-05	1.159450E-05	4.627000E-10	69				
019	high1	2.247640E-05	2.247640E-05	1.000000E-13	60				
019	high2	2.220890E-05	2.220890E-05	0.000000E+00	285				
020	high1	3.040382E-05	3.040210E-05	1.719100E-09	34				
020	high2	2.850882E-05	2.850830E-05	5.190000E-10	286				
021	high1	1.157740E-05	1.157740E-05	0.000000E+00	354				
021	high2	1.072890E-05	1.072890E-05	0.000000E+00	9				
022	high1	4.775160E-05	4.775160E-05	0.000000E+00	103				
022	high2	4.075970E-05	4.075970E-05	0.000000E+00	255				
023	high1	1.859889E-05	1.859850E-05	3.921000E-10	233				
023	high2	1.808900E-05	1.808900E-05	0.000000E+00	288				
024	high1	1.690270E-05	1.690270E-05	1.700000E-12	13				
024	high2	1.598839E-05	1.598830E-05	9.250000E-11	233				
025	high1	2.821832E-05	2.820540E-05	1.292330E-08	225				
025	high2	2.460168E-05	2.459900E-05	2.680900E-09	226				
026	high1	2.394783E-05	2.394650E-05	1.327000E-09	285				
026	high2	2.310565E-05	2.310210E-05	3.552900E-09	69				
027	high1	2.236842E-05	2.236110E-05	7.317900E-09	285				
027	high2	1.794267E-05	1.792260E-05	2.007130E-08	60				
028	high1	3.655514E-05	3.655420E-05	9.437999E-10	34				
028	high2	3.493520E-05	3.493520E-05	1.400000E-12	295				
029	high1	1.784850E-05	1.784850E-05	0.000000E+00	274				
029	high2	1.694829E-05	1.694640E-05	1.888900E-09	16				
030	high1	1.430680E-05	1.430680E-05	0.000000E+00	274				
030	high2	1.302469E-05	1.302420E-05	4.933000E-10	354				
031	high1	8.258239E-06	8.258000E-06	2.395000E-10	297				
031	high2	7.689007E-06	7.688400E-06	6.074000E-10	282				
032	high1	1.808857E-05	1.808850E-05	7.080000E-11	256				
032	high2	1.443624E-05	1.443620E-05	3.580000E-11	359				
033	high1	5.988400E-06	5.988400E-06	0.000000E+00	256				
033	high2	4.391912E-06	4.387800E-06	4.111500E-09	359				
034	high1	2.982701E-06	2.982700E-06	9.000000E-13	256				
034	high2	2.732020E-06	2.730300E-06	1.720500E-09	359				
035	high1	2.767412E-06	2.767400E-06	1.170000E-11	256				
035	high2	2.554029E-06	2.553100E-06	9.291000E-10	359				

Output of the PM10 annual files for 1981.
Including FDM & PAL of:
vehicles combined
erosion
vehicles & erosion

Concentrations are in grams per cubic meter

Receptor	FDM Total conc.	Vehicle conc.	Erosion conc.	PAL Total conc.	Vehicle conc.	Erosion conc.
1	8.919441E-08	8.900000E-08	1.944089E-10	9.069275E-08	9.069275E-08	6.202740E-10
2	8.851548E-08	8.800000E-08	5.154792E-10	5.032781E-08	5.032781E-08	8.980822E-11
3	1.319462E-08	1.300000E-08	1.946173E-10	9.458392E-09	9.458392E-09	1.875891E-12
4	1.903873E-08	1.900000E-08	3.872849E-11	7.657030E-09	7.657030E-09	4.742466E-10
5	4.105130E-08	4.100000E-08	5.129943E-11	7.285399E-09	7.285399E-09	1.191781E-12
6	3.913551E-08	3.900000E-08	1.355096E-10	5.261959E-09	5.261959E-09	1.992329E-12
7	3.217523E-08	3.200000E-08	1.752290E-10	5.318250E-09	5.318250E-09	1.505205E-10
8	2.416345E-08	2.400000E-08	1.634512E-10	4.234116E-09	4.234116E-09	3.879452E-11
9	1.713668E-08	1.700000E-08	1.366767E-10	3.291046E-09	3.291046E-09	4.736986E-11
10	1.213839E-08	1.200000E-08	1.383926E-10	2.608769E-09	2.608769E-09	5.238356E-11
11	1.012793E-08	1.000000E-08	1.279312E-10	2.118760E-09	2.118760E-09	3.967124E-11
12	8.099728E-09	8.000001E-09	9.972822E-11	1.736310E-09	1.736310E-09	2.931507E-11
13	7.075066E-09	7.000000E-09	7.506603E-11	1.440294E-09	1.440294E-09	2.197808E-11
14	5.059006E-09	5.000000E-09	5.900547E-11	1.226015E-09	1.226015E-09	1.864110E-11
15	4.048883E-09	4.000000E-09	4.888301E-11	1.076175E-09	1.076175E-09	1.214247E-11
16	4.039896E-09	4.000000E-09	3.989589E-11	1.034531E-09	1.034531E-09	4.010959E-12
17	6.042254E-09	6.000000E-09	4.225342E-11	1.118396E-09	1.118396E-09	6.824657E-13
18	7.061819E-09	7.000000E-09	6.181890E-11	1.278001E-09	1.278001E-09	1.431781E-13
19	8.065737E-09	8.000001E-09	6.573644E-11	1.550780E-09	1.550780E-09	0.000000E+00
20	8.079399E-09	8.000001E-09	7.939891E-11	1.925154E-09	1.925154E-09	0.000000E+00
21	1.009827E-08	1.000000E-08	9.826547E-11	2.430484E-09	2.430484E-09	0.000000E+00
22	1.109413E-08	1.100000E-08	9.413070E-11	2.901652E-09	2.901652E-09	0.000000E+00
23	1.008877E-08	1.000000E-08	8.877095E-11	3.053107E-09	3.053107E-09	0.000000E+00
24	1.309564E-08	1.300000E-08	9.564220E-11	3.142507E-09	3.142507E-09	0.000000E+00
25	1.412955E-08	1.400000E-08	1.295515E-10	2.826559E-09	2.826559E-09	0.000000E+00
26	1.521934E-08	1.500000E-08	2.193433E-10	2.856803E-09	2.856803E-09	0.000000E+00
27	1.619393E-08	1.600000E-08	1.939287E-10	3.384320E-09	3.384320E-09	0.000000E+00
28	1.633270E-08	1.600000E-08	3.327052E-10	5.490840E-09	5.490840E-09	0.000000E+00
29	1.829390E-08	1.800000E-08	2.938962E-10	1.376426E-08	1.376426E-08	0.000000E+00
30	2.023335E-08	2.000000E-08	2.333540E-10	2.308453E-08	2.308453E-08	1.912877E-10
31	9.850561E-08	9.800001E-08	5.056044E-10	9.905491E-08	9.905491E-08	6.405479E-10
32	4.543639E-09	4.000000E-09	5.436386E-10	7.704961E-10	7.704961E-10	6.052055E-13
33	3.040385E-09	3.000000E-09	4.038465E-11	7.176335E-10	7.176335E-10	1.660000E-11
34	4.034326E-09	4.000000E-09	3.432629E-11	8.232887E-10	8.232887E-10	9.410959E-12
35	5.035655E-09	5.000000E-09	3.565480E-11	9.894906E-10	9.894906E-10	1.123836E-11
36	5.034331E-09	5.000000E-09	3.433067E-11	1.059001E-09	1.059001E-09	3.068493E-11
37	7.037924E-09	7.000000E-09	3.792438E-11	9.296269E-10	9.296269E-10	0.000000E+00
38	7.032248E-09	7.000000E-09	3.224795E-11	1.749026E-09	1.749026E-09	8.835616E-12

Receptor	FDM Total conc.	Vehicle conc.	Erosion conc.	PAL Total conc.	Vehicle conc.	Erosion conc.
39	3.025721E-09	3.000000E-09	2.572109E-11	1.830289E-09	1.830289E-09	2.078630E-11
40	9.009816E-09	9.000001E-09	9.815065E-12	6.320418E-09	6.320418E-09	1.659452E-11
41	1.004156E-08	1.000000E-08	4.155890E-11	9.206350E-09	9.206350E-09	2.370137E-10
42	3.097449E-09	3.000000E-09	9.744875E-11	3.319587E-09	3.319587E-09	1.453151E-11
43	4.053667E-09	4.000000E-09	5.366657E-11	2.642017E-09	2.642017E-09	0.000000E+00
44	4.021874E-09	4.000000E-09	2.187369E-11	9.042966E-10	9.042966E-10	0.000000E+00
45	4.057330E-09	4.000000E-09	5.733014E-11	7.597324E-10	7.597324E-10	0.000000E+00
46	3.029804E-09	3.000000E-09	2.980411E-11	7.614445E-10	7.614445E-10	0.000000E+00
47	4.050980E-09	4.000000E-09	5.097972E-11	1.354328E-09	1.354328E-09	0.000000E+00
48	4.034548E-09	4.000000E-09	3.454793E-11	1.116898E-09	1.116898E-09	0.000000E+00
49	3.040205E-09	3.000000E-09	4.020521E-11	5.961678E-10	5.961678E-10	1.939178E-13
50	3.030903E-09	3.000000E-09	3.090273E-11	5.730810E-10	5.730810E-10	1.171233E-11
51	3.022543E-09	3.000000E-09	2.254274E-11	5.363265E-10	5.363265E-10	4.523288E-12
52	3.021823E-09	3.000000E-09	2.182246E-11	4.977005E-10	4.977005E-10	1.476438E-11
53	3.017143E-09	3.000000E-09	1.714301E-11	4.909027E-10	4.909027E-10	1.221644E-11
54	3.017318E-09	3.000000E-09	1.731753E-11	4.075069E-10	4.075069E-10	2.838356E-14
55	3.016611E-09	3.000000E-09	1.661069E-11	4.360591E-10	4.360591E-10	0.000000E+00
56	3.016677E-09	3.000000E-09	1.667698E-11	8.664751E-10	8.664751E-10	3.071233E-12
57	1.012083E-09	1.000000E-09	1.208328E-11	8.733145E-10	8.733145E-10	7.882191E-12
58	1.004454E-09	1.000000E-09	4.454247E-12	1.655144E-09	1.655144E-09	9.865753E-14
59	7.006063E-09	7.000000E-09	6.062739E-12	4.090861E-09	4.090861E-09	3.150685E-11
60	4.035488E-09	4.000000E-09	3.548794E-11	4.739836E-09	4.739836E-09	1.112603E-10
61	3.043805E-09	3.000000E-09	4.380465E-11	2.132150E-09	2.132150E-09	2.387397E-11
62	1.043027E-09	1.000000E-09	4.302685E-11	1.452879E-09	1.452879E-09	1.575342E-14
63	3.008720E-09	3.000000E-09	8.720274E-12	1.113202E-09	1.113202E-09	0.000000E+00
64	1.014857E-09	1.000000E-09	1.485726E-11	4.938328E-10	4.938328E-10	0.000000E+00
65	2.017507E-09	2.000000E-09	1.750712E-11	3.277893E-10	3.277893E-10	0.000000E+00
66	2.023493E-09	2.000000E-09	2.349287E-11	3.600709E-10	3.600709E-10	0.000000E+00
67	2.013052E-09	2.000000E-09	1.305123E-11	3.424158E-10	3.424158E-10	0.000000E+00
68	3.008243E-09	3.000000E-09	8.242465E-12	5.857188E-10	5.857188E-10	0.000000E+00
69	3.027791E-09	3.000000E-09	2.779095E-11	8.090714E-10	8.090714E-10	0.000000E+00
70	3.018456E-09	3.000000E-09	1.845589E-11	7.679438E-10	7.679438E-10	0.000000E+00
71	3.024304E-09	3.000000E-09	2.430411E-11	4.807907E-10	4.807907E-10	5.364384E-14
72	2.023545E-09	2.000000E-09	2.354465E-11	5.061727E-10	5.061727E-10	6.443835E-12
73	2.017170E-09	2.000000E-09	1.717014E-11	4.266357E-10	4.266357E-10	7.183561E-12
74	2.020828E-09	2.000000E-09	2.082821E-11	3.831229E-10	3.831229E-10	2.090137E-12
75	1.012786E-09	1.000000E-09	1.278602E-11	3.399789E-10	3.399789E-10	1.384657E-11
76	1.011503E-09	1.000000E-09	1.150273E-11	2.993926E-10	2.993926E-10	6.364383E-12
77	1.010139E-09	1.000000E-09	1.013945E-11	2.591410E-10	2.591410E-10	1.421644E-13
78	1.010739E-09	1.000000E-09	1.073917E-11	2.783248E-10	2.783248E-10	0.000000E+00
79	2.008680E-09	2.000000E-09	8.680272E-12	2.773962E-10	2.773962E-10	0.000000E+00
80	1.010822E-09	1.000000E-09	1.082191E-11	5.473950E-10	5.473950E-10	1.478904E-12
81	7.409900E-12	0.000000E+00	7.409862E-12	4.517723E-10	4.517723E-10	4.068493E-11
82	1.003778E-09	1.000000E-09	3.777810E-12	6.417655E-10	6.417655E-10	3.364384E-13

Receptor	FDM Total conc.	Vehicle conc.	Erosion conc.	PAL Total conc.	Vehicle conc.	Erosion conc.
83	1.002601E-09	1.000000E-09	2.601097E-12	9.716301E-10	9.716301E-10	4.884932E-14
84	3.003448E-09	3.000000E-09	3.447946E-12	1.936065E-09	1.936065E-09	8.273973E-12
85	4.014908E-09	4.000000E-09	1.490822E-11	2.814222E-09	2.814222E-09	3.654795E-11
86[1]	3.028058E-09	3.000000E-09	2.805754E-11	1.861649E-08	1.861649E-08*	6.643835E-10*
87	3.024126E-09	3.000000E-09	2.412603E-11	2.085987E-09	2.085987E-09	5.994521E-11
88	1.049141E-09	1.000000E-09	4.914082E-11	1.248581E-09	1.248581E-09	1.179726E-11
89	1.028893E-09	1.000000E-09	2.889314E-11	1.005413E-09	1.005413E-09	3.758904E-13
90	6.091500E-12	0.000000E+00	6.091507E-12	8.629624E-10	8.629624E-10	0.000000E+00
91	1.006637E-09	1.000000E-09	6.636985E-12	6.442359E-10	6.442359E-10	0.000000E+00
92	1.122270E-11	0.000000E+00	1.122274E-11	3.186003E-10	3.186003E-10	0.000000E+00
93	1.008687E-09	1.000000E-09	8.686848E-12	2.244892E-10	2.244892E-10	0.000000E+00
94	1.018338E-09	1.000000E-09	1.833781E-11	1.947085E-10	1.947085E-10	0.000000E+00
95	1.018830E-09	1.000000E-09	1.882959E-11	2.267639E-10	2.267639E-10	0.000000E+00
96	1.005109E-09	1.000000E-09	5.109316E-12	2.676805E-10	2.676805E-10	0.000000E+00
97	2.014897E-09	2.000000E-09	1.489698E-11	4.297825E-10	4.297825E-10	0.000000E+00
98	2.019108E-09	2.000000E-09	1.910767E-11	6.638347E-10	6.638347E-10	0.000000E+00
99	3.015034E-09	3.000000E-09	1.503397E-11	1.562716E-06[2]	1.562716E-06	
100[3]	9.002390E-08	8.999999E-08	2.390849E-11			
101	8.851481E-08	8.800000E-08	5.148143E-10			
102	9.819423E-08	9.800001E-08	1.942308E-10			
N1	1.252713E-06	1.252000E-06	7.127110E-10			
N2	1.347864E-06	1.347000E-06	8.645126E-10			
N3	8.049994E-07	8.040000E-07	9.994164E-10			
N4	5.971364E-07	5.960000E-07	1.136411E-09			
N5	4.843034E-07	4.830000E-07	1.303353E-09			
N6	4.115106E-07	4.100000E-07	1.510601E-09			
N7	3.577381E-07	3.560000E-07	1.738079E-09			
01	2.350000E-07	2.350000E-07	2.472384E-15			
02	3.130000E-07	3.130000E-07	5.654893E-15			
03	7.640000E-07	7.640000E-07	7.072512E-15			
04	8.390000E-07	8.390000E-07	6.315716E-15			
05	7.580000E-07	7.580000E-07	6.208653E-15			
06	6.890000E-07	6.890000E-07	5.656759E-15			
07	7.130000E-07	7.130000E-07	4.966873E-15			
08	8.720000E-07	8.720000E-07	1.870381E-15			

[1] For PAL, receptor 86 is not the same location as for FDM.

[2] For PAL, receptor 99 was set at point N1. Erosion was not done for this point.

[3] Points 100,101,102 are the same location as 1,2,31 but the receptor is at a height of 1 meter rather than 2 meters.

Receptor	FDM Total conc.	Vehicle conc.	Erosion conc.	PAL Total conc.	Vehicle conc.	Erosion conc.
09	9.839999E-07	9.839999E-07	1.212166E-15			
010	8.260000E-07	8.260000E-07	1.049762E-15			
011	7.180000E-07	7.180000E-07	1.269139E-15			
012	6.490000E-07	6.490000E-07	1.319862E-15			
013	5.990000E-07	5.990000E-07	1.238063E-15			
014	7.930000E-07	7.930000E-07	3.359685E-16			
015	5.460000E-07	5.460000E-07	2.675370E-16			
016	6.190000E-07	6.190000E-07	3.766392E-16			
017	8.000000E-07	8.000000E-07	4.805792E-16			
018	9.690000E-07	9.690000E-07	4.411260E-16			
019	1.168000E-06	1.168000E-06	5.390058E-16			
020	1.375000E-06	1.375000E-06	5.958614E-16			
021	1.759000E-06	1.759000E-06	5.853211E-16			
022	1.493000E-06	1.493000E-06	1.284593E-15			
023	1.268000E-06	1.268000E-06	1.161608E-15			
024	1.009000E-06	1.009000E-06	1.952225E-15			
025	1.009000E-06	1.009000E-06	2.117680E-15			
026	1.336000E-06	1.336000E-06	2.096337E-15			
027	1.483000E-06	1.483000E-06	2.248548E-15			
028	1.690000E-06	1.690000E-06	2.996221E-15			
029	2.001000E-06	2.001000E-06	3.419675E-15			
030	1.951000E-06	1.951000E-06	3.223698E-15			
031	1.189000E-06	1.189000E-06	2.734950E-15			
032	1.630000E-06	1.630000E-06	4.481167E-15			
033	4.870000E-07	4.870000E-07	4.429629E-15			
034	3.080000E-07	3.080000E-07	2.201480E-15			
035	2.660000E-07	2.660000E-07	2.058688E-15			

Output of the lead files for the first quarter of 1981.
Including FDM & PAL of:
total: vehicles & erosion
vehicles combined
erosion

Concentrations are in grams per cubic meter

Receptor	FDM Total conc.	Vehicle conc.	Erosion conc.	PAL Total conc.	Vehicle conc.	Erosion conc.
1	1.204474D-08	1.200000D-08	4.474111D-11	1.264956E-08	1.263185E-08	1.770525E-11
2	1.001151D-08	1.000000D-08	1.151333D-11	7.213292E-09	7.198787E-09	1.450530E-11
3	1.002221D-09	1.000000D-09	2.221111D-12	1.905255E-09	1.898054E-09	7.200632E-12
4	1.004203D-09	1.000000D-09	4.203333D-12	1.935081E-09	1.930818E-09	4.262537E-12
5	3.005327D-09	3.000000D-09	5.326667D-12	1.715652E-09	1.708585E-09	7.067081E-12
6	3.007042D-09	3.000000D-09	7.042222D-12	1.080288E-09	1.075357E-09	4.931013E-12
7	3.006723D-09	3.000000D-09	6.723333D-12	9.769364E-10	9.696894E-10	7.247019E-12
8	3.008273D-09	3.000000D-09	8.273333D-12	6.787371E-10	6.711108E-10	7.626286E-12
9	1.006043D-09	1.000000D-09	6.043333D-12	5.110784E-10	5.057412E-10	5.337152E-12
10	1.005843D-09	1.000000D-09	5.843333D-12	4.186008E-10	4.147733E-10	3.827550E-12
11	1.005027D-09	1.000000D-09	5.026667D-12	3.535045E-10	3.507066E-10	2.797866E-12
12	1.004127D-09	1.000000D-09	4.126667D-12	2.943920E-10	2.922279E-10	2.164131E-12
13	3.531100D-12	0.000000D+00	3.531111D-12	2.458310E-10	2.441041E-10	1.726942E-12
14	3.021100D-12	0.000000D+00	3.021111D-12	2.074111E-10	2.059613E-10	1.449785E-12
15	2.628900D-12	0.000000D+00	2.628889D-12	1.847912E-10	1.835905E-10	1.200704E-12
16	2.478900D-12	0.000000D+00	2.478889D-12	1.885528E-10	1.874211E-10	1.131728E-12
17	2.218900D-12	0.000000D+00	2.218889D-12	2.192698E-10	2.177046E-10	1.565189E-12
18	2.553300D-12	0.000000D+00	2.553333D-12	2.564608E-10	2.542319E-10	2.228903E-12
19	3.043300D-12	0.000000D+00	3.043333D-12	3.076608E-10	3.045083E-10	3.152521E-12
20	3.338900D-12	0.000000D+00	3.338889D-12	3.792068E-10	3.752635E-10	3.943304E-12
21	3.273300D-12	0.000000D+00	3.273333D-12	4.736224E-10	4.688733E-10	4.749138E-12
22	2.795600D-12	0.000000D+00	2.795556D-12	5.353598E-10	5.302741E-10	5.085703E-12
23	1.002904D-09	1.000000D-09	2.904444D-12	5.062643E-10	5.015474E-10	4.716875E-12
24	1.003399D-09	1.000000D-09	3.398889D-12	4.697995E-10	4.653482E-10	4.451259E-12
25	1.007913D-09	1.000000D-09	7.913333D-12	4.323943E-10	4.285413E-10	3.852942E-12
26	1.011893D-09	1.000000D-09	1.189333D-11	4.442893E-10	4.404758E-10	3.813536E-12
27	2.018732D-09	2.000000D-09	1.873222D-11	6.186400E-10	6.095707E-10	9.069238E-12
28	3.021776D-09	3.000000D-09	2.177556D-11	1.057261E-09	1.033505E-09	2.375622E-11
29	3.024007D-09	3.000000D-09	2.400667D-11	1.298844E-09	1.276594E-09	2.225035E-11
30	3.029967D-09	3.000000D-09	2.996667D-11	2.503969E-09	2.483676E-09	2.029319E-11
31	1.304640D-08	1.300000D-08	4.639778D-11	1.387477E-08	1.385626E-08	1.851047E-11
32	1.433300D-12	0.000000D+00	1.433333D-12	1.452761E-10	1.443012E-10	9.748988E-13
33	1.587800D-12	0.000000D+00	1.587778D-12	1.136558E-10	1.126987E-10	9.571152E-13
34	1.667800D-12	0.000000D+00	1.667778D-12	1.303311E-10	1.289194E-10	1.411723E-12
35	2.347800D-12	0.000000D+00	2.347778D-12	1.729159E-10	1.707555E-10	2.160419E-12
36	1.281100D-12	0.000000D+00	1.281111D-12	1.953391E-10	1.940859E-10	1.253190E-12
37	1.162200D-12	0.000000D+00	1.162222D-12	1.820522E-10	1.805647E-10	1.487512E-12
38	9.921999D-13	0.000000D+00	9.922222D-13	3.924927E-10	3.915495E-10	9.431903E-13

Receptor	FDM Total conc.	Vehicle conc.	Erosion conc.	PAL Total conc.	Vehicle conc.	Erosion conc.
39	4.944000D-13	0.000000D+00	4.944444D-13	4.311939E-10	4.292545E-10	1.939376E-12
40	1.002103D-09	1.000000D-09	2.103333D-12	8.756850E-10	8.728223E-10	2.862721E-12
41	1.006009D-09	1.000000D-09	6.008889D-12	1.433082E-09	1.426105E-09	6.977448E-12
42	3.530000D-12	0.000000D+00	3.530000D-12	3.899671E-10	3.866916E-10	3.275526E-12
43	3.644400D-12	0.000000D+00	3.644444D-12	2.493661E-10	2.477602E-10	1.605941E-12
44	1.324400D-12	0.000000D+00	1.324444D-12	2.066154E-10	2.054003E-10	1.215136E-12
45	3.001100D-12	0.000000D+00	3.001111D-12	1.139997E-10	1.133266E-10	6.731352E-13
46	2.010000D-12	0.000000D+00	2.010000D-12	1.169589E-10	1.164047E-10	5.541557E-13
47	7.667000D-13	0.000000D+00	7.666667D-13	2.342513E-10	2.324808E-10	1.770489E-12
48	1.305600D-12	0.000000D+00	1.305556D-12	2.135555E-10	2.114226E-10	2.132855E-12
49	9.833000D-13	0.000000D+00	9.833334D-13	1.122380E-10	1.114162E-10	8.218178E-13
50	1.336700D-12	0.000000D+00	1.336667D-12	9.157767E-11	9.087985E-11	6.978149E-13
51	1.046700D-12	0.000000D+00	1.046667D-12	8.476012E-11	8.384005E-11	9.200669E-13
52	1.107800D-12	0.000000D+00	1.107778D-12	8.545759E-11	8.444681E-11	1.010773E-12
53	5.267000D-13	0.000000D+00	5.266667D-13	9.279211E-11	9.227353E-11	5.185824E-13
54	5.333000D-13	0.000000D+00	5.333333D-13	7.583033E-11	7.548039E-11	3.499357E-13
55	3.778000D-13	0.000000D+00	3.777778D-13	9.851060E-11	9.759057E-11	9.200359E-13
56	3.000000D-13	0.000000D+00	3.000000D-13	1.859838E-10	1.854836E-10	5.002328E-13
57	2.144000D-13	0.000000D+00	2.144444D-13	2.114346E-10	2.103590E-10	1.075569E-12
58	4.311000D-13	0.000000D+00	4.311111D-13	2.624875E-10	2.614354E-10	1.052112E-12
59	1.002304D-09	1.000000D-09	2.304444D-12	4.751037E-10	4.738785E-10	1.225167E-12
60	3.274400D-12	0.000000D+00	3.274444D-12	7.325376E-10	7.292726E-10	3.265072E-12
61	2.848900D-12	0.000000D+00	2.848889D-12	2.731128E-10	2.701997E-10	2.913071E-12
62	1.097800D-12	0.000000D+00	1.097778D-12	1.550846E-10	1.542891E-10	7.955184E-13
63	1.516700D-12	0.000000D+00	1.516667D-12	1.102429E-10	1.097979E-10	4.449956E-13
64	3.589000D-13	0.000000D+00	3.588889D-13	1.087003E-10	1.082343E-10	4.659981E-13
65	1.592200D-12	0.000000D+00	1.592222D-12	6.461352E-11	6.437949E-11	2.340252E-13
66	1.453300D-12	0.000000D+00	1.453333D-12	5.234862E-11	5.207525E-11	2.733676E-13
67	4.378000D-13	0.000000D+00	4.377778D-13	5.919553E-11	5.897949E-11	2.160411E-13
68	6.989000D-13	0.000000D+00	6.988889D-13	8.322960E-11	8.278880E-11	4.408046E-13
69	3.567000D-13	0.000000D+00	3.566667D-13	1.395948E-10	1.386304E-10	9.644202E-13
70	7.944000D-13	0.000000D+00	7.944444D-13	1.440573E-10	1.426507E-10	1.406549E-12
71	7.667000D-13	0.000000D+00	7.666667D-13	8.922856E-11	8.851518E-11	7.133745E-13
72	1.066700D-12	0.000000D+00	1.066667D-12	8.166082E-11	8.110247E-11	5.583416E-13
73	7.778000D-13	0.000000D+00	7.777778D-13	6.550002E-11	6.487635E-11	6.236779E-13
74	8.700000D-13	0.000000D+00	8.700000D-13	6.527897E-11	6.442238E-11	8.565904E-13
75	5.256000D-13	0.000000D+00	5.255556D-13	5.552631E-11	5.496010E-11	5.662059E-13
76	2.833000D-13	0.000000D+00	2.833333D-13	5.732704E-11	5.703027E-11	2.967648E-13
77	3.833000D-13	0.000000D+00	3.833333D-13	4.762537E-11	4.743894E-11	1.864267E-13
78	2.600000D-13	0.000000D+00	2.600000D-13	5.703904E-11	5.667279E-11	3.662439E-13
79	3.078000D-13	0.000000D+00	3.077778D-13	6.759589E-11	6.700088E-11	5.950179E-13
80	1.667000D-13	0.000000D+00	1.666667D-13	1.141184E-10	1.137866E-10	3.318195E-13
81	3.744000D-13	0.000000D+00	3.744444D-13	1.096708E-10	1.094100E-10	2.607834E-13
82	7.560000D-14	0.000000D+00	7.555556D-14	1.359147E-10	1.350208E-10	8.938650E-13

Receptor	FDM Total conc.	Vehicle conc.	Erosion conc.	PAL Total conc.	Vehicle conc.	Erosion conc.
83	2.500000D-13	0.000000D+00	2.500000D-13	1.532830E-10	1.526690E-10	6.139796E-13
84	6.533000D-13	0.000000D+00	6.533334D-13	2.526704E-10	2.517991E-10	8.713342E-13
85	2.242200D-12	0.000000D+00	2.242222D-12	3.205200E-10	3.196361E-10	8.839057E-13
86[1]	2.085600D-12	0.000000D+00	2.085556D-12	2.697705E-09	2.682624E-09	1.508150E-11
87	1.616700D-12	0.000000D+00	1.616667D-12	2.954713E-10	2.934306E-10	2.040708E-12
88	1.610000D-12	0.000000D+00	1.610000D-12	1.585733E-10	1.570216E-10	1.551676E-12
89	4.067000D-13	0.000000D+00	4.066667D-13	1.282457E-10	1.277414E-10	5.042678E-13
90	8.144000D-13	0.000000D+00	8.144445D-13	8.599297E-11	8.562680E-11	3.661697E-13
91	9.178000D-13	0.000000D+00	9.177778D-13	6.623590E-11	6.599329E-11	2.426114E-13
92	1.133000D-13	0.000000D+00	1.133333D-13	5.766721E-11	5.742116E-11	2.460470E-13
93	2.333000D-13	0.000000D+00	2.333333D-13	5.305114E-11	5.274128E-11	3.098628E-13
94	1.125600D-12	0.000000D+00	1.125556D-12	3.359434E-11	3.352429E-11	7.004784E-14
95	5.378000D-13	0.000000D+00	5.377778D-13	3.580954E-11	3.562189E-11	1.876520E-13
96	4.511000D-13	0.000000D+00	4.511111D-13	4.583373E-11	4.568603E-11	1.476937E-13
97	4.444000D-13	0.000000D+00	4.444444D-13	6.009175E-11	5.978429E-11	3.074644E-13
98	2.889000D-13	0.000000D+00	2.888889D-13	1.180433E-10	1.172139E-10	8.293881E-13
99	7.356000D-13	0.000000D+00	7.355556D-13	1.795190E-10	1.097473E-10	6.977170E-11
100[2]	1.204467D-08	1.200000D-08	4.467000D-11			
101	1.001145D-08	1.000000D-08	1.145111D-11			
102	1.404633D-08	1.400000D-08	4.632778D-11			
N1	2.270466D-07	2.270000D-07	4.663111D-11			
N2	2.460542D-07	2.460000D-07	5.424889D-11			
N3	1.470614D-07	1.470000D-07	6.143556D-11			
N4	1.080720D-07	1.080000D-07	7.203111D-11			
N5	8.608970D-08	8.599999D-08	8.970222D-11			
N6	7.011582D-08	7.000000D-08	1.158178D-10			
N7	5.914895D-08	5.900000D-08	1.489478D-10			
O1	2.111772D-08	2.100000D-08	1.177189D-10			
O2	3.529812D-08	3.500000D-08	2.981244D-10			
O3	1.165300D-07	1.160000D-07	5.300100D-10			
O4	1.443967D-07	1.440000D-07	3.966700D-10			
O5	1.482137D-07	1.480000D-07	2.136778D-10			
O6	1.362110D-07	1.360000D-07	2.110278D-10			
O7	1.232244D-07	1.230000D-07	2.244467D-10			
O8	1.441328D-07	1.440000D-07	1.327756D-10			
O9	1.490626D-07	1.490000D-07	6.258889D-11			
O10	1.500720D-07	1.500000D-07	7.199556D-11			
O11	1.340836D-07	1.340000D-07	8.355778D-11			

[1]The location of receptor 86 is different for FDM and PAL.

[2]Points 100,101,102 are the same location as 1,2,31 but the receptor is at a height of 1 meter rather than 2 meters.

Receptor	FDM Total conc.	Vehicle conc.	Erosion conc.	PAL Total conc.	Vehicle conc.	Erosion conc.
012	1.180836D-07	1.180000D-07	8.357556D-11			
013	1.100771D-07	1.100000D-07	7.714445D-11			
014	1.850235D-07	1.850000D-07	2.351556D-11			
015	9.601684D-08	9.600000D-08	1.684111D-11			
016	1.100195D-07	1.100000D-07	1.954111D-11			
017	1.430233D-07	1.430000D-07	2.333667D-11			
018	1.700216D-07	1.700000D-07	2.161556D-11			
019	2.550264D-07	2.550000D-07	2.637000D-11			
020	3.200294D-07	3.200000D-07	2.938333D-11			
021	2.970347D-07	2.970000D-07	3.474667D-11			
022	3.410626D-07	3.410000D-07	6.256111D-11			
023	2.390526D-07	2.390000D-07	5.262000D-11			
024	1.830689D-07	1.830000D-07	6.888445D-11			
025	2.070903D-07	2.070000D-07	9.029778D-11			
026	2.710763D-07	2.710000D-07	7.630889D-11			
027	2.810888D-07	2.810000D-07	8.882667D-11			
028	4.311162D-07	4.310000D-07	1.162000D-10			
029	3.421146D-07	3.420000D-07	1.146022D-10			
030	3.081134D-07	3.080000D-07	1.134322D-10			
031	1.571867D-07	1.570000D-07	1.866500D-10			
032	2.232761D-07	2.230000D-07	2.761089D-10			
033	5.028279D-08	5.000000D-08	2.827878D-10			
034	2.711094D-08	2.700000D-08	1.109389D-10			
035	2.310205D-08	2.300000D-08	1.020489D-10			

Receptor	FDM Total conc.	Vehicle conc.	Erosion conc.	PAL Total conc.	Vehicle conc.	Erosion conc.

Output of the PAH annual files.
Including FDM & PAL of:
- total
- vehicles combined
- erosion
- vapor

Concentrations are in grams per cubic meter

Receptor	FDM Total conc.	Vehicle conc.	Erosion conc.	Vapor conc.	PAL Total conc.	Vehicle conc.	Erosion conc.	Vapor conc.
1	2.027373D-12	2.020455D-12	2.211700D-15	4.706000D-15	6.521670D-12	3.314339D-12	2.020548D-17	3.207311D-12
2	1.848431D-12	1.845080D-12	5.680054D-16	2.783000D-15	4.045843D-12	1.933113D-12	2.926027D-18	2.112727D-12
3	2.869837D-13	2.852680D-13	1.076773D-16	1.608000D-15	1.618391D-12	3.434293D-13	6.112329D-20	1.274962D-12
4	4.069695D-13	4.048150D-13	2.074868D-16	1.947000D-15	1.600966D-12	2.822220D-13	1.545479D-17	1.318729D-12
5	9.766349D-13	9.733110D-13	2.608252D-16	3.063000D-15	1.766252D-12	2.614793D-13	3.882192D-20	1.504773D-12
6	8.836478D-13	8.796180D-13	3.447978D-16	3.685000D-15	1.875034D-12	1.974234D-13	6.490411D-20	1.677610D-12
7	6.859300D-13	6.816510D-13	3.309701D-16	3.948000D-15	2.181497D-12	1.945476D-13	4.904110D-18	1.986944D-12
8	5.096844D-13	5.046990D-13	4.063729D-16	4.579000D-15	2.686650D-12	1.502955D-13	1.263562D-18	2.536353D-12
9	3.587289D-13	3.526570D-13	2.948951D-16	5.777000D-15	3.430523D-12	1.147717D-13	1.543288D-18	3.315750D-12
10	2.672720D-13	2.587920D-13	2.839877D-16	8.196000D-15	4.735379D-12	8.986684D-14	1.706575D-18	4.645510D-12
11	2.110080D-13	1.971460D-13	2.439704D-16	1.361800D-14	7.281225D-12	7.206056D-14	1.292329D-18	7.209163D-12
12	1.746462D-13	1.557540D-13	2.001868D-16	1.869200D-14	1.024749D-11	5.860056D-14	9.553425D-19	1.018889D-11
13	1.448141D-13	1.252480D-13	1.710721D-16	1.939500D-14	1.160681D-11	4.823838D-14	7.161644D-19	1.155857D-11
14	1.423873D-13	1.036180D-13	1.462723D-16	3.862300D-14	6.272135D-12	4.060386D-14	6.073973D-19	6.231530D-12
15	1.178961D-13	8.824500D-14	1.270784D-16	2.952400D-14	4.618332D-12	3.524596D-14	3.956165D-19	4.583085D-12
16	1.264363D-13	9.005600D-14	1.203206D-16	3.626000D-14	6.652086D-12	3.346436D-14	1.307123D-19	6.618621D-12
17	1.748080D-13	1.150060D-13	1.080090D-16	5.969400D-14	1.348006D-11	3.595106D-14	2.223836D-20	1.344411D-11
18	1.700487D-13	1.370280D-13	1.247332D-16	3.289600D-14	6.816055D-12	4.114820D-14	4.665753D-21	6.774907D-12
19	1.718915D-13	1.546620D-13	1.484578D-16	1.708100D-14	7.838947D-12	4.973910D-14	0.000000D+00	7.789208D-12
20	1.723017D-13	1.653190D-13	1.626896D-16	6.820000D-15	6.195892D-12	6.194343D-14	0.000000D+00	6.133949D-12
21	1.887799D-13	1.837890D-13	1.588636D-16	4.832000D-15	3.422847D-12	7.802036D-14	0.000000D+00	3.344827D-12
22	2.071840D-13	2.029780D-13	1.349934D-16	4.071000D-15	2.396535D-12	9.227620D-14	0.000000D+00	2.304259D-12
23	1.951584D-13	1.912970D-13	1.403565D-16	3.721000D-15	2.065214D-12	9.678685D-14	0.000000D+00	1.968427D-12
24	2.431192D-13	2.389900D-13	1.652085D-16	3.964000D-15	1.990454D-12	1.000776D-13	0.000000D+00	1.890376D-12
25	2.562428D-13	2.513180D-13	3.877342D-16	4.537000D-15	1.946094D-12	9.153302D-14	0.000000D+00	1.854561D-12
26	2.908169D-13	2.848570D-13	5.709257D-16	5.389000D-15	1.932303D-12	9.515746D-14	0.000000D+00	1.837146D-12
27	2.952505D-13	2.878660D-13	9.035194D-16	6.481000D-15	2.363595D-12	1.139501D-13	0.000000D+00	2.249645D-12
28	3.199044D-13	3.097540D-13	1.041426D-15	9.109000D-15	5.098570D-12	1.801864D-13	0.000000D+00	4.918384D-12
29	3.684244D-13	3.598960D-13	1.155412D-15	7.373000D-15	6.903472D-12	4.618730D-13	0.000000D+00	6.441599D-12
30	4.284013D-13	4.173430D-13	1.449316D-15	9.609000D-15	9.648658D-12	8.017487D-13	6.232877D-18	8.846903D-12
31	2.227776D-12	2.220614D-12	2.293771D-15	4.868000D-15	6.946511D-12	3.629285D-12	2.087123D-17	3.317205D-12
32	8.334403D-14	7.167800D-14	7.003041D-17	1.159600D-14	1.789764D-12	2.430916D-14	1.972055D-20	1.765455D-12

Receptor	FDM Total conc.	Vehicle conc.	Erosion conc.	Vapor conc.	PAL Total conc.	Vehicle conc.	Erosion conc.	Vapor conc.
33	6.509011D-14	6.007200D-14	7.710547D-17	4.941000D-15	8.118010D-13	2.335740D-14	5.408219D-19	7.884431D-13
34	8.399298D-14	7.885500D-14	8.097205D-17	5.057000D-15	6.867195D-13	2.728338D-14	3.065753D-19	6.594358D-13
35	1.071560D-13	1.051960D-13	1.150244D-16	1.845000D-15	8.315036D-13	3.329479D-14	3.663014D-19	7.982085D-13
36	1.193003D-13	1.177660D-13	6.225972D-17	1.472000D-15	8.451825D-13	3.581939D-14	1.000000D-18	8.093621D-13
37	1.581548D-13	1.564700D-13	5.683370D-17	1.628000D-15	7.525669D-13	3.150317D-14	0.000000D+00	7.210637D-13
38	1.361821D-13	1.347790D-13	4.809425D-17	1.355000D-15	7.069314D-13	5.986033D-14	2.879452D-19	6.470708D-13
39	5.381137D-14	5.243600D-14	2.436822D-17	1.351000D-15	7.198063D-13	6.232578D-14	6.772603D-19	6.574798D-13
40	1.790709D-13	1.777930D-13	1.039329D-16	1.174000D-15	1.184487D-12	2.196125D-13	5.405479D-19	9.648743D-13
41	2.186768D-13	2.168150D-13	2.938285D-16	1.568000D-15	1.795021D-12	3.147703D-13	7.723288D-18	1.480243D-12
42	5.957662D-14	5.847000D-14	1.696159D-16	9.370000D-16	9.561758D-13	1.140437D-13	4.734246D-19	8.421316D-13
43	8.172026D-14	8.044400D-14	1.762515D-16	1.100000D-15	9.449441D-13	9.020303D-14	0.000000D+00	8.547411D-13
44	6.436174D-14	6.312700D-14	6.473973D-17	1.170000D-15	6.659871D-13	3.029520D-14	0.000000D+00	6.356919D-13
45	7.526174D-14	7.384800D-14	1.467329D-16	1.267000D-15	6.904582D-13	2.498878D-14	0.000000D+00	6.654694D-13
46	6.206831D-14	6.076100D-14	9.830685D-17	1.209000D-15	8.710577D-13	2.408639D-14	0.000000D+00	8.469713D-13
47	8.161240D-14	7.854900D-14	3.739397D-17	3.026000D-15	1.047003D-12	4.187610D-14	0.000000D+00	1.005127D-12
48	8.463371D-14	7.974400D-14	6.370410D-17	4.826000D-15	7.861565D-13	3.464256D-14	0.000000D+00	7.515139D-13
49	6.036822D-14	5.471100D-14	4.821699D-17	5.609000D-15	8.434505D-13	1.851601D-14	6.317808D-21	8.249345D-13
50	4.774160D-14	4.386800D-14	6.459753D-17	3.809000D-15	6.152243D-13	1.832200D-14	3.816438D-19	5.969020D-13
51	5.006483D-14	4.767700D-14	5.082438D-17	2.337000D-15	3.107181D-13	1.724681D-14	1.473973D-19	2.934711D-13
52	4.849925D-14	4.688200D-14	5.424904D-17	1.563000D-15	3.285634D-13	1.597750D-14	4.810959D-19	3.125854D-13
53	4.982178D-14	4.892400D-14	2.578027D-17	8.720000D-16	2.704090D-13	1.593653D-14	3.980822D-19	2.544721D-13
54	6.497919D-14	6.429800D-14	2.618713D-17	6.550000D-16	3.323528D-13	1.351898D-14	9.249315D-22	3.188338D-13
55	6.732046D-14	6.662200D-14	1.845644D-17	6.800000D-16	3.267542D-13	1.445293D-14	0.000000D+00	3.123013D-13
56	5.970978D-14	5.913500D-14	1.477534D-17	5.600000D-16	3.552995D-13	2.843982D-14	1.001096D-19	3.268596D-13
57	2.281554D-14	2.218300D-14	1.054301D-17	6.220000D-16	4.015936D-13	2.870975D-14	2.568493D-19	3.728836D-13
58	3.594888D-14	3.496400D-14	2.088027D-17	9.640000D-16	5.741130D-13	5.462254D-14	3.213699D-21	5.194905D-13
59	1.347624D-13	1.336850D-13	1.133734D-16	9.640000D-16	8.772705D-13	1.370328D-13	1.026301D-18	7.402367D-13
60	9.855359D-14	9.748400D-14	1.595890D-16	9.100000D-16	1.035311D-12	1.571587D-13	3.624657D-18	8.781487D-13
61	4.427879D-14	4.349600D-14	1.377932D-16	6.450000D-16	6.512232D-13	7.131422D-14	7.778082D-19	5.799082D-13
62	2.477713D-14	2.422800D-14	5.312712D-17	4.960000D-16	5.031240D-13	4.921297D-14	5.134246D-22	4.539110D-13
63	3.819946D-14	3.754600D-14	7.346301D-17	5.800000D-16	4.380712D-13	3.772564D-14	0.000000D+00	4.003456D-13
64	2.313375D-14	2.257000D-14	1.775260D-17	5.460000D-16	3.598228D-13	1.634545D-14	0.000000D+00	3.434773D-13
65	2.946189D-14	2.881000D-14	7.688959D-17	5.750000D-16	3.772268D-13	1.084246D-14	0.000000D+00	3.663843D-13
66	3.354206D-14	3.289200D-14	7.105424D-17	5.790000D-16	4.009384D-13	1.157106D-14	0.000000D+00	3.893673D-13
67	3.059381D-14	2.949500D-14	2.180521D-17	1.077000D-15	3.884909D-13	1.093156D-14	0.000000D+00	3.775593D-13
68	4.123927D-14	4.019400D-14	3.426904D-17	1.011000D-15	2.770394D-13	1.792726D-14	0.000000D+00	2.591121D-13
69	4.561259D-14	4.376800D-14	1.758794D-17	1.827000D-15	3.167348D-13	2.432928D-14	0.000000D+00	2.924055D-13
70	5.385857D-14	5.114600D-14	3.857562D-17	2.674000D-15	5.104885D-13	2.328579D-14	0.000000D+00	4.872027D-13
71	4.677443D-14	4.328300D-14	3.742767D-17	3.454000D-15	5.189143D-13	1.462892D-14	1.748219D-21	5.042854D-13
72	3.864351D-14	3.581900D-14	5.151150D-17	2.773000D-15	4.974445D-13	1.591585D-14	2.099452D-19	4.815285D-13
73	3.636383D-14	3.461300D-14	3.782576D-17	1.713000D-15	2.945847D-13	1.344694D-14	2.341096D-19	2.811375D-13
74	3.531453D-14	3.388300D-14	4.252712D-17	1.389000D-15	1.690528D-13	1.201355D-14	6.810959D-20	1.570392D-13
75	3.115492D-14	2.999400D-14	2.591589D-17	1.135000D-15	1.469800D-13	1.058654D-14	4.512329D-19	1.363930D-13
76	2.819480D-14	2.730000D-14	1.380301D-17	8.810000D-16	2.071023D-13	9.350282D-15	2.073425D-19	1.977518D-13

Receptor	FDM Total conc.	Vehicle conc.	Erosion conc.	Vapor conc.	PAL Total conc.	Vehicle conc.	Erosion conc.	Vapor conc.
77	3.469466D-14	3.416300D-14	1.865836D-17	5.130000D-16	1.468806D-13	8.316980D-15	4.632877D-21	1.385636D-13
78	3.492981D-14	3.450000D-14	1.281370D-17	4.170000D-16	1.739476D-13	8.897275D-15	0.000000D+00	1.650503D-13
79	3.908904D-14	3.868600D-14	1.504384D-17	3.880000D-16	1.977924D-13	8.843225D-15	0.000000D+00	1.889492D-13
80	3.405726D-14	3.366800D-14	8.256711D-18	3.810000D-16	2.122378D-13	1.739133D-14	4.819178D-20	1.948464D-13
81	1.301434D-14	1.269000D-14	1.833836D-17	3.060000D-16	2.320383D-13	1.442427D-14	1.325205D-18	2.176127D-13
82	1.414582D-14	1.373400D-14	3.824109D-18	4.080000D-16	2.782498D-13	2.033913D-14	1.095890D-20	2.579106D-13
83	1.969601D-14	1.897700D-14	1.201315D-17	7.070000D-16	3.799777D-13	3.107683D-14	1.592055D-21	3.489009D-13
84	4.880912D-14	4.805000D-14	3.211315D-17	7.270000D-16	5.672446D-13	6.275494D-14	2.696164D-19	5.044894D-13
85	7.523436D-14	7.434200D-14	1.103608D-16	7.820000D-16	6.785964D-13	9.167963D-14	1.190685D-18	5.869156D-13
86[1]	5.641542D-14	5.568300D-14	1.014192D-16	6.310000D-16	3.578662D-12*	6.415992D-13*	2.164932D-17*	2.937041D-12*
87	4.230270D-14	4.168000D-14	7.869726D-17	5.440000D-16	5.432663D-13	6.807140D-14	1.953425D-18	4.751929D-13
88	2.495476D-14	2.444300D-14	7.775562D-17	4.340000D-16	4.337438D-13	4.123271D-14	3.843836D-19	3.925107D-13
89	1.293656D-14	1.256300D-14	1.955589D-17	3.540000D-16	3.526536D-13	3.345546D-14	1.225206D-20	3.191981D-13
90	1.161433D-14	1.123200D-14	3.933507D-17	3.430000D-16	3.084048D-13	2.889880D-14	0.000000D+00	2.795060D-13
91	2.390639D-14	2.347900D-14	4.439260D-17	3.830000D-16	2.689311D-13	2.150451D-14	0.000000D+00	2.474266D-13
92	1.139151D-14	1.113300D-14	5.507671D-18	2.530000D-16	2.526911D-13	1.047321D-14	0.000000D+00	2.422179D-13
93	1.622151D-14	1.586000D-14	1.151507D-17	3.500000D-16	2.361913D-13	7.269184D-15	0.000000D+00	2.289221D-13
94	2.006101D-14	1.957400D-14	5.401178D-17	4.330000D-16	2.332625D-13	6.314061D-15	0.000000D+00	2.269484D-13
95	1.982845D-14	1.922700D-14	2.644548D-17	5.750000D-16	1.794063D-13	7.141220D-15	0.000000D+00	1.722651D-13
96	2.354031D-14	2.294000D-14	2.230438D-17	5.780000D-16	1.471217D-13	8.283549D-15	0.000000D+00	1.388382D-13
97	2.911893D-14	2.820000D-14	2.193041D-17	8.970000D-16	1.586475D-13	1.288661D-14	0.000000D+00	1.457609D-13
98	3.764616D-14	3.630700D-14	1.415425D-17	1.325000D-15	2.449677D-13	1.962369D-14	0.000000D+00	2.253440D-13
99	4.579097D-14	4.340000D-14	3.597206D-17	2.355000D-15	5.391441D-13	1.804671D-14	1.246027D-17	5.210849D-13
100[2]	2.026577D-12	2.019662D-12	2.208454D-15	4.706000D-15				
101	1.844752D-12	1.841404D-12	5.649986D-16	2.783000D-15				
102	2.229738D-12	2.222579D-12	2.290522D-15	4.868000D-15				
N1	4.128691D-11	4.126529D-11	1.119708D-14	1.042400D-14				
N2	4.501822D-11	4.499288D-11	1.351017D-14	1.183400D-14				
N3	2.766323D-11	2.763433D-11	1.563555D-14	1.326100D-14				
N4	2.001613D-11	1.998374D-11	1.782989D-14	1.456300D-14				
N5	1.577682D-11	1.574097D-11	2.049511D-14	1.535400D-14				
N6	1.299463D-11	1.295455D-11	2.380423D-14	1.628400D-14				
N7	1.096493D-11	1.092024D-11	2.748986D-14	1.720600D-14				
01	5.306373D-12	5.243773D-12	3.965026D-14	2.295000D-14				
02	7.601888D-12	7.467398D-12	9.804738D-14	3.644300D-14				
03	2.512354D-11	2.493470D-11	1.460226D-13	4.281700D-14				
04	3.000804D-11	2.982957D-11	1.349839D-13	4.348500D-14				
05	2.769940D-11	2.752212D-11	1.357485D-13	4.152900D-14				

[1]Receptor 86 has different locations for PAL and FDM.

[2]Points 100,101,102 are the same location as 1,2,31 but the receptor is at a height of 1 meter rather than 2 meters.

Receptor	FDM Total conc.	Vehicle conc.	Erosion conc.	Vapor conc.	PAL Total conc.	Vehicle conc.	Erosion conc.	Vapor conc.
06	2.445386D-11	2.428764D-11	1.275295D-13	3.868700D-14				
07	2.374391D-11	2.359547D-11	1.076832D-13	4.075300D-14				
08	2.848882D-11	2.841118D-11	3.804853D-14	3.959200D-14				
09	3.044631D-11	3.038783D-11	2.334419D-14	3.513600D-14				
010	2.597166D-11	2.592440D-11	1.810099D-14	2.915500D-14				
011	2.231536D-11	2.227046D-11	2.104924D-14	2.384900D-14				
012	2.021191D-11	2.017182D-11	2.137834D-14	1.871700D-14				
013	1.943523D-11	1.939934D-11	1.968164D-14	1.620100D-14				
014	3.571056D-11	3.569543D-11	5.851678D-15	9.272000D-15				
015	1.904940D-11	1.903717D-11	4.778671D-15	7.443000D-15				
016	2.502935D-11	2.501437D-11	6.519701D-15	8.465000D-15				
017	3.501346D-11	3.499585D-11	8.168310D-15	9.439000D-15				
018	4.021239D-11	4.019429D-11	7.671038D-15	1.042600D-14				
019	5.468614D-11	5.466480D-11	9.331730D-15	1.200400D-14				
020	6.805468D-11	6.802958D-11	1.050036D-14	1.459900D-14				
021	6.249704D-11	6.246713D-11	1.112759D-14	1.878500D-14				
022	6.825973D-11	6.820910D-11	2.649786D-14	2.413300D-14				
023	5.138312D-11	5.133964D-11	2.378973D-14	1.969100D-14				
024	4.334045D-11	4.328248D-11	3.913919D-14	1.883000D-14				
025	5.191529D-11	5.185073D-11	4.511884D-14	1.944500D-14				
026	6.587638D-11	6.581123D-11	4.533185D-14	1.982000D-14				
027	6.542811D-11	6.535890D-11	4.911082D-14	2.010500D-14				
028	9.588663D-11	9.579487D-11	6.575118D-14	2.600500D-14				
029	8.215143D-11	8.205089D-11	7.277360D-14	2.776700D-14				
030	7.299872D-11	7.290486D-11	6.785078D-14	2.600800D-14				
031	3.629109D-11	3.621240D-11	5.552926D-14	2.316700D-14				
032	5.601722D-11	5.588889D-11	9.406652D-14	3.425800D-14				
033	1.237335D-11	1.225982D-11	8.031019D-14	3.322200D-14				
034	7.367621D-12	7.311473D-12	3.608166D-14	2.006600D-14				
035	6.167405D-12	6.114364D-12	3.294472D-14	2.009600D-14				

The following pages include a directory tree and filelist of the disk portion of this appendix.

Overall directory structure

```
──FDM
│  ├──VAPOR
│  ├──PAH
│  ├──EROSION
│  │   ├──LEAD
│  │   ├──PM10
│  │   │   ├──1979
│  │   │   └──1981
│  │   └──PAH
│  ├──LEAD
│  ├──PM10
│  ├──MAXNET
│  └──ONSITE
│
├──PAL
│  ├──EROSION
│  ├──PAH
│  ├──VAPOR
│  ├──LEAD
│  └──PM10
│
├──MET
│
└──EMISSION
   ├──EROSION
   ├──VAPOR
   └──VEHICLE
```

Directory structure of disks

```
disk INTRO&F1
  ├──INTRODUCTION/CONTENTS
  └──FDM (non-erosion)
       ├──VAPOR
       ├──PAH
       ├──LEAD
       └──PM10
```

```
disk FEL
  └──FDM
      └──EROSION
          └──LEAD
disks FEPM1-FEPM2
  └──FDM
      └──EROSION
          └──PM10
              └──1979
disks FEPM3-FEPM4
  └──FDM
      └──EROSION
          └──PM10
              └──1981
disks FEPAH1-FEPAH2
  └──FDM
      └──EROSION
          └──PAH
disk FMAXNET1-FMAXNET2
  └──FDM
      └──MAXNET
disk FONSITE1-FONSITE2
  └──FDM
      └──ONSITE
disks PE1-PE4
  └──PAL
      └──EROSION
disks PPAH1-PPAH5
  └──PAL
      └──PAH
disks PV1-PV3
  └──PAL
      └──VAPOR
disks PL1-PL5
  └──PAL
      └──LEAD
disks PPM1-PPM10
  └──PAL
      └──PM10
disks MET1-MET2
  └──MET
disk EMISSION
  ├──VAPOR
  ├──VEHICLE
  └──EROSION
```

disk INTRO&F1 (Introduction/tree structure/FDM, non-erosion)

```
introduction
tree structure
arc.exe       (32,184)

fdmexe.arc   (242,507)
FDM\VAPOR     (66,775)
FDM\PAH      (105,899)
FDM\LEAD     (251,788)
FDM\PM10     (130,387)
```

disk FEL (FDM, lead erosion)

```
FDM\EROSION\LEAD (502,524)
```

disk FEPM1 (FDM, 1979 PM10 erosion I)

```
FDM\EROSION\PM10\1979
       epmo79p1.arc (1,029,724)
       read79.epm       (1,017)
       template.79      (4,252)
       gofdm79.bat     (15,454)
       em_dpm79.prn    (24,321)
       arc.exe         (32,184)
```

disk FEPM2 (FDM, 1979 PM10 erosion II)* no room for arc.exe

```
FDM\EROSION\PM10\1979
       epmo79p2.arc (828,754)
       fug79in.arc  (353,130)
```

disk FEPM3 (FDM, 1981 PM10 erosion I)

```
FDM\EROSION\PM10\1981
       read81.epm       (908)
       epmo81p1.arc (879,904)
       template.81    (4,251)
       gofdm81.bat   (13,744)
       em_dpm81.prn  (24,296)
       fdmeros.bas    (4,181)
       arc.exe       (32,184)
```

disk FEPM4 (FDM, 1981 PM10 erosion II)

```
FDM\EROSION\PM10\1981
        epmo81p2.arc  (767,469)
        fug81in.arc   (241,030)
        gofdm81.bat    (13,744)
        arc.exe        (32,184)
```

disk FEPAH1 (FDM, PAH erosion I)

```
FDM\EROSION\PAH
        epho81p1.arc  (937,134)
        readme.eph        (998)
        template.pah    (4,290)
        gofdmh81.bat   (13,744)
        em_dph81.prn   (24,234)
        arc.exe        (32,184)
        fdmeros.bas     (4,181)
```

disk FEPAH2 (FDM, PAH erosion II)

```
FDM\EROSION\PAH
        epho81p2.arc  (814,066)
        epahin81.arc  (244,118)
        arc.exe        (32,184)
```

disk FMAXNET1 (FDM maxnet I)

```
FDM\MAXNET
        readme.max        (406)
        fepbout.arc   (588,782)
        fephout.arc   (595,066)
        framenet.arc    (1,569)
```

disk FMAXNET2 (FDM maxnet II)

```
FDM\MAXNET
        fepmout.arc   (580,362)
        maxnet.arc     (76,531)
        fepbin.arc     (90,239)
        fephin.arc     (90,663)
        fepmin.arc     (89,650)
        arc.exe        (32,184)
```

disk FONSITE1 (FDM onsite I)

```
FDM\ONSITE
        readme.on          (343)
        onsitout.arc    (31,827)
        onsitein.arc     (7,301)
        fphout.arc     (935,667)
        fpbout.arc     (211,063)
```

disk FONSITE2 (FDM onsite II)

```
FDM\ONSITE
        fepmout.arc    (910,693)
        fepbin.arc      (31,556)
        fephin.arc     (134,860)
        fepmin.arc     (133,090)
```

disk PE1 (PAL, EROSION I)

```
palexe.arc          (466,617)
arc.exe              (32,184)
PAL\EROSION
        readme.ero       (3,052)
        posteros.arc    (10,565)
        paleros.arc    (640,358)
```

disk PE2 (PAL, EROSION II)

```
PAL\EROSION
        pepm1081.arc   (659,490)
        arc.exe         (32,184)
```

disk PE3 (PAL, EROSION III)

```
PAL\EROSION
        pepb81.arc     (661,987)
        arc.exe         (32,184)
```

disk PE4 (PAL, EROSION IV)

```
PAL\EROSION
        pepah81.arc    (661,177)
        arc.exe         (32,184)
```

disk PPAH1 (PAL, PAH I)

```
PAL\PAH
        readme.pah        (1,652)
        postpah.arc       (9,144)
        palpahin.arc    (396,169)
        payphc78.arc    (618,807)
        arc.exe          (32,184)
```

disk PPAH2 (PAL, PAH II)

```
PAL\PAH
        payphc79.arc    (627,750)
        arc.exe          (32,184)
```

disk PPAH3 (PAL, PAH III)

```
PAL\PAH
        payphc80.arc    (607,530)
        arc.exe          (32,184)
```

disk PPAH4 (PAL, PAH IV)

```
PAL\PAH
        payphc81.arc    (619,644)
        arc.exe          (32,184)
```

disk PPAH5 (PAL, PAH V)

```
PAL\PAH
        payphc87.arc    (627,127)
        arc.exe          (32,184)
```

disk PV1 (PAL, VAPOR I)

```
PAL\VAPOR
        readme.vap          (768)
        postvap.arc       (5,635)
        pyphvin.arc     (400,742)
        pvpout78.arc    (492,385)
        arc.exe          (32,184)
```

disk PV2 (PAL, VAPOR II)

```
PAL\VAPOR
        pvpout79.arc   (492,385)
        pvpout80.arc   (487,626)
        arc.exe         (32,184)
```

disk PV3 (PAL, VAPOR III)

```
PAL\VAPOR
        pvpout81.arc   (490,327)
        pvpout87.arc   (482,820)
        arc.exe         (32,184)
```

disk PL1 (PAL, LEAD I)

```
PAL\LEAD
        readme.ppb          (851)
        gopal.bat           (448)
        avgpbq.bas          (922)
        sum1pbce.81       (3,081)
        palpbin.arc     (407,488)
        palpb78.arc     (631,954)
        arc.exe          (32,184)
```

disk PL2 (PAL, LEAD II)

```
PAL\LEAD
        palpb79.arc     (640,645)
        arc.exe          (32,184)
```

disk Pl3 (PAL, LEAD III)

```
PAL\LEAD
        palpb80.arc     (638,997)
        arc.exe          (32,184)
```

disk PL4 (PAL, LEAD IV)

```
PAL\LEAD
        palpb81.arc     (626,270)
        arc.exe          (32,184)
```

disk PL5 (PAL, LEAD V)

```
PAL\LEAD
        palpb87.arc    (631,954)
        arc.exe         (32,184)
```

disk PPM1 (PAL, PM10 I)

```
PAL\PM10
        readme.pm        (2,664)
        gopal.bat          (108)
        postpm.arc      (30,555)
        palypmin.arc   (404,510)
        paypmc78.arc   (633,844)
        arc.exe         (32,184)
```

disk PPM2 (PAL, PM10 II)

```
PAL\PM10
        paldpmin.arc   (405,124)
        paypmc79.arc   (619,756)
        arc.exe         (32,184)
```

disk PPM3 (PAL, PM10 III)

```
PAL\PM10
        paypmc80.arc   (615,664)
        arc.exe         (32,184)
```

disk PPM4 (PAL, PM10 IV)

```
PAL\PM10
        paypmc81.arc   (618,772)
        arc.exe         (32,184)
```

disk PPM5 (PAL, PM10 V)

```
PAL\PM10
        paypmc87.arc   (617,805)
        arc.exe         (32,184)
```

disk PPM6 (PAL, PM10 VI)

```
PAL\PM10
        padpmc78.arc   (614,221)
        arc.exe         (32,184)
```

disk PPM7 (PAL, PM10 VII)

```
PAL\PM10
        padpmc79.arc  (618,882)
        arc.exe        (32,184)
```

disk PPM8 (PAL, PM10 VIII)

```
PAL\PM10
        padpmc80.arc  (601,746)
        arc.exe        (32,184)
```

disk PPM9 (PAL, PM10 IX)

```
PAL\PM10
        padpmc81.arc  (611,632)
        arc.exe        (32,184)
```

disk PPM10 (PAL, PM10 X)

```
PAL\PM10
        padpmc87.arc  (619,657)
        arc.exe        (32,184)
```

disk MET1 (Met data I)

```
        readme.met        (829)
        palram.arc    (561,078)
        arc.exe        (32,184)
```

disk MET2 (Met data II)

```
        rambin.arc    (726,304)
        arc.exe        (32,184)
```

disk EMISSION (Emission)

```
arc.exe               (32,184)

VAPOR
        vapor.arc       (6,790)
VEHICLE
        vehicle.arc    (40,901)
EROSION
        erosion.arc   (641,695)
```